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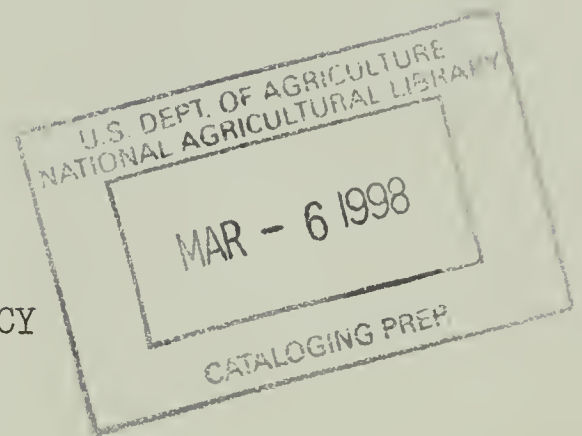
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LAND AND WATER RESOURCES POLICY



Revision by Task Force of May 1962 Report of  
USDA Land and Water Policy Committee

UNITED STATES DEPARTMENT OF AGRICULTURE

Washington, D.C.

July 1965

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DEPARTMENT OF AGRICULTURE  
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MEMORANDUM

TO: USDA Assistant Secretaries, Directors,  
Assistants to the Secretary and Agency Heads

FROM: John A. Baker, Chairman  
USDA Land and Water Policy Committee

SUBJECT: Interim Report - Land and Water Resources Policy

This interim report, "Land and Water Resources Policy," was prepared by a task force for the Department's Land and Water Policy Committee as a revision of the report "Land and Water Resources - A Policy Guide," issued in May 1962. Although not approved in its present form for release as a Committee report, it will be used as working material by the Committee to identify and initiate deliberations on major issues as a step in developing resource policy proposals. It is believed that the interim report will also provide information of significance for internal use by USDA agencies concerned with land and water resource programs and policies.

This report generally substantiates the basic conclusions of the 1962 Committee report, despite some changes in assumptions and expectations. It also clarifies some of the controversial interpretations that were made of material contained in the earlier report.

On the basis of the assumptions used, the report finds that the Nation's food and fiber requirements can be met with about 417 million acres of cropland in 1980. This is 41 million acres less than the cropland acreage we had in 1959. In addition to cropland under diversion programs, the 1959 cropland acreage includes land used for crops, rotation pasture, and idle cropland. The projected acreage in need of being shifted would be primarily in place of existing diversion programs, and not in addition to such programs. The acreage requirements projected in this report are about 10 million acres more than in the 1962 report, with a corresponding reduction of 10 million in the acreage available for shifting to noncrop uses.

This 41 million acres represents a net reduction from 1959 in cropland of average productivity. In considering the magnitude of the gross shift from crop to other uses by 1980, account must also be taken of the additional cropland that will be added by that time. This report estimates that 18 million acres of new cropland will be brought into production by 1980, bringing the total acreage in excess of requirements to 59 million acres. Partially offsetting the addition of new cropland would be a shift of cropland to urban and other related nonagricultural uses of about 6 million acres, leaving about 53 million acres as the remaining amount in need of being shifted or kept from crop uses by 1980.



The acreage shifts likely to be in need of program assistance might include a part of the 6 million acres shifting to rotation pasture, and perhaps a part of the 6-million acre shift to urban related uses. Thus, program assistance may need to be provided for around 55 million acres by 1980. This would involve a diversion program of about the same scale as that prevailing in recent years, but would substitute longer term for annual contracts.

It is believed that this report will be of assistance in the continuing task of building and improving national land and water policy. Activities essential for developing systematic policy include continuous research and planning on basic resource management problems, timely surveys and analyses of the land and water situation, and periodic review and appraisal of major resource policy issues. Such activities serve to guide internal Departmental decisions, promote a broader understanding of problems and provide a more adequate basis for working with others in developing solutions.

July 1965



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## PART I. INTRODUCTION

### Background

The establishment of a USDA Land and Water Policy Committee and the preparation of this report were authorized in Secretary's Memorandum No. 1464, August 24, 1961. The Committee assignment was to review the present and prospective land, forest, and water resource situation, appraise implications for Department activities, and prepare policy and program recommendations. This statement represents a revision and refinement by a Committee task force of the first report issued in May 1962. The views expressed are those of the task force and do not necessarily represent the position of the Committee.

The Department of Agriculture finds it useful and necessary to take a forward look at the demands likely to be placed upon available land and water resources in the future. The projections in this report extend to the year 1980. Such projections reflect the most likely direction of changes. The assurance that may be attached to forecasts of such factors as future population growth, crop yields, economic activity, technologies, exports, imports, weather and natural disasters is, of course, limited. Influences not now predictable may significantly affect the actual rates of change. The projections, however, are considered to provide useful guides for current public programs and individual decisions involving the use and development of land and water resources.

There is obvious need for periodic reappraisals of the resource situation to make adjustments for departures from assumptions, unforeseeable developments, and revised expectations. But many decisions cannot long be deferred and, accordingly, must be based on the best available information and prevailing outlook. The task force believes that implementation of the recommendations contained in this report would improve the Nation's ability to cope with the demands on resources likely to arise both during and beyond the selected projection period.

Based on the assumptions used, the study indicates that food and fiber requirements in 1980 could be met with 417 million acres of cropland, or about 40 million acres less than we had in 1959. An acreage approaching that in various temporary land diversion programs in recent years should be shifted to other uses for at least the duration of the projection period. Although likely to be in surplus for crop production for an extended period, this acreage is a valuable land resource and must be managed to conserve its potential for other uses and for future generations. In the interim, it is in the social interest that other desirable uses be found for such land.

The influence of agriculture on water resource supplies and uses will remain important in the years ahead. Agriculture is expected to continue as the predominant consumptive user of water well beyond 1980. The conservation and economic management of water in agricultural uses is critical for the balanced growth of all water-using industries and the entire economy.

The recommendations of the report are designed to present a balanced program of land and water resource development, improvement, and adjustment of cropland, pasture, range and woodland. While provision is made for the orderly improvement of cropland through carefully selected irrigation, drainage, flood protection, watershed and other conservation measures, such activities should be in balance with programs for adjusting land use in accordance with needs. Thus, public programs to assist and facilitate land-use production adjustments have been proposed along with programs for conservation and development.

A program of research, education, planning, and technical and financial assistance has been outlined to guide land and water resource adjustment, use, and development. Stress is placed on the need for an adequate basis for decisions and informed participation at all levels of interest. These activities will require placing heavy reliance on programs conducted in cooperation with State agricultural colleges, universities, and others.

Major emphasis throughout the report is placed on the economic encouragement of family farms, forests, and recreation enterprises.

Although this task force revision of the 1962 report reflects numerous modifications in particular assumptions and expectations, the basic appraisal of the situation and the resulting conclusions remain substantially unchanged. The effects of a lower population projection and higher yields were substantially offset by anticipated higher exports and lower levels of livestock feeding efficiency. The projected cropland requirements in this revision are about 10 million acres higher than in the previous report. This expansion is due mainly to increased allowances for such cropland uses as cultivated summer fallow, soil improvement and idle cropland and cropland used for pasture. It is believed that the revisions made improve the reliability of the various components of the estimates.

### Guiding Principles

The land and water resources of the United States are vital national assets. How we conserve, develop, and manage these natural resources will affect our economic growth, the strength of our Nation, and our position in world affairs.

A large part of these natural resources are privately owned and operated under the laws of the 50 States. The Department of Agriculture has the major responsibility for cooperative programs with the States, local governments, and groups and individuals to conserve, develop, and manage soil, water, grass, forest, and wildlife habitat on private lands. Such programs include research, education, extension, technical, credit, and financial assistance. The Department administers a multiple-use sustained-yield program on the National Forests and National Grasslands.



A major objective of a policy for land and water is that these basic resources serve all the people of the Nation. Those who depend on farming, ranching, and forestry should be helped through research, education and operations programs to assess their needs and find solutions to problems they cannot solve for themselves. Policy should assure an abundant and wholesome food supply; adequate sources and supplies of fiber, forest products, and industrial raw materials; and should assist in the conservation of the land, water, and forest resources.

Conservation is the maintenance of the productive capacity of our land and water resources, and their development or improvement to meet future requirements. The Department's goal is to devise land and water programs and production-management programs that will enhance farm income and achieve long-run and short-run conservation objectives.

Since returns from private or public investment in land and water resource conservation or development occur over a long period, projections of probable future conditions are necessary in reaching current decisions. Since statistical calculations of the Nation's future requirements and potentials can only indicate the probable direction of change, adequate provision must be made for unforeseen contingencies.

Present public actions and the individual choices now being made by millions of landowners regarding resource use often limit future choices. In some cases, it is physically possible to reverse decisions, but it may not be economically feasible. Institutional arrangements may also lead to nonreversible decisions because vested rights or legislative priorities such as rights to water, permits, easements, covenants, etc., may be created which virtually preclude future choices desirable from an economic or social viewpoint.

Because of the long-run and complex nature of many decisions regarding land and water use, it is desirable to state major principles to guide specific policy and program decisions:

- o Land and water policy should rest on a firm foundation of factual data and analysis.

- o Land and water policy should be consistent both with general economic policy and agricultural policy in promoting efficient production and providing opportunities for farm people to realize returns from farming or alternative employment comparable to those of other sectors.

- o Land and water policy should be comprehensive--for the Nation, for all regions, for all its land and water resources, and for all resource users.

- o People directly affected should have ample and continuing opportunity to participate in the formulation of policies in the operation of programs.

- ° The combined powers and efforts of the State and Federal governments should be employed in carrying out policies and programs without undue restrictions on freedom of individual decisions.
- ° Land and water resources should be so combined with other resources that the goods and services produced will be in accord with both present and future needs.
- ° Programs should make the best use of funds available for investment in land and water conservation and development.
- ° Costs of resource programs should be borne in relation to the sharing of the benefits insofar as is consistent with other public purposes.
- ° Land and water development programs should contribute to community, regional, and national economic growth.
- ° Programs should be flexible enough to respond to changing needs and provide reserves for unforeseen conditions, yet specific enough to achieve immediate objectives.
- ° Policies should be formulated and programs managed to achieve widespread benefits to farm people and others dependent on land and water resources.
- ° Policies should recognize the Nation's limited supply of water and of land and should follow sound management and conservation principles that are in accord with social values in the use of these vital assets.

#### Land and Water Problems

A projection of land use based on meeting estimated future requirements indicates that the increased demands for agricultural products in 1980 can be met with about 40 million fewer acres of cropland of average productivity than were available in 1959, provided there is a continuation of the high rate of increase in technological improvements and crop yields at a rate equal to the trend since 1950, and with appropriate research, planning, and action.

The following major problems need to be taken into account if we are to build better land and water policies and programs:

We can expect our farm production potential to continue to outrun demand at least until 1980. Long-range land-use adjustment programs must be devised to maintain efficient production and at the same time make adjustments needed to meet effective demand.



Many acres of unsuitable land are still devoted to crop production. More efficient use of resources and manpower will result from shifting such land to more suitable uses.

Some development and improvement of crop and pasturelands through irrigation, drainage, and flood control is expected to continue for developing family farms, reducing production costs and risks, and for local and regional growth. These improvements have been taken into account in projecting land-use production requirements. A balance between such developments and land-use adjustment activities will need to be maintained.

Our rapidly growing population will need greatly increased quantities of land and water for recreation, urban, and industrial activities. At present many of these needs are met in a haphazard and unplanned way. This is exemplified by the suburban sprawl, the encroachment on potential parklands and open space around our major cities, impairment of water quality, and increasing costs of water for urban and industrial needs.

New employment opportunities will be needed to offset any loss of jobs associated with taking land out of food and fiber production. These new opportunities will be needed to support local communities and farm families.

Local needs and plans, as well as national programs, should be provided for in coordinated resource development. Principles and procedures for the sharing of responsibility between various Federal, State, and local groups are needed. Private and public roles in all aspects of resource use must be delineated and coordinated.

We need clear understanding of, and agreement upon, the relative advantages of different ways of changing land use, such as acreage allotments, quantity allotments, cost sharing, land rentals, easements, and land purchase.

A majority of owners of small forested parcels are following poor management practices. The reasons should be more clearly understood so that owners can be encouraged to adopt efficient practices that conserve forest and water uses. Incentives to good management must be found.

The abatement and control of environmental pollution is of increasing significance in rural areas. Types include product contamination, water pollution, soil pollution, air pollution, and landscape blight. There is both pressing need and extensive opportunity for the development and preservation of an attractive countryside affording a better environment for the enjoyment of living.

Land and water problems are of increasing concern to both farm and nonfarm people. Public awareness of these problems and alternative solutions must be generated and the public kept informed of current and projected land and water requirements. Carefully planned programs that will satisfy both rural and urban needs are essential.

### Land and Water Policy Highlights

The following outline summarizes the major elements of a recommended policy for directing the Department's land and water activities toward desired goals and objectives. The more comprehensive discussion presented in part VI indicates that Department policy should encourage:

1. Resource uses that will yield continuing maximum benefits. Activities should be designed to promote adequate and efficient production; effective continuing use and management of resources; farm output geared to requirements; desirable other uses for lands not needed for agricultural production; and patterns of use and resource development schedules that support economic growth and a balanced and strong economy.
2. Opportunities for earning adequate farm income. Farmers should have the opportunity to earn incomes from farming or alternative employment comparable to other sectors of the economy; compensation and other assistance should be provided for participation in land-use production adjustment, production management, and conservation programs; programs should promote greater income stability; and additional sources of income from new resource uses should be developed.
3. Conservation and efficient use of land and water resources. The use and management of resources should be such as to safeguard productive capacity; protect and improve cropland, grassland, forest and recreational areas, reduce flood and sediment damage, and improve the quality and dependability of water; and preserve selected primitive, wilderness, and wild land and water areas.

Practices for improving the efficiency of water use on farms should be developed and applied and expanded cooperative research undertaken with States on equitable water-use laws and the clarification of water rights. National Forests and Grasslands should be managed to improve water yields and assistance provided to landowners to promote appropriate water management practices.
4. Increased efficiency and owner operation of family enterprises. The Department should direct its research and extension efforts to the continued technological improvement of family enterprises, including the development and adaptation of practices for maintaining high soil productivity; using improved plant varieties; protecting against disease, insects, and weeds; effective management of soils in accord with their



capability; optimum use of lands for farming, grazing, forestry, recreation, and wildlife management; and other practices for increasing the efficiency of family operations.

Owner operation of efficient family enterprises should be encouraged through developing management, production, and marketing arrangements and facilities designed for such enterprises; credit and financial assistance should be provided for ownership and operation; Department programs should be administered to promote family farms and widespread income distribution; and improved institutional and educational means of strengthening family farm operation and ownership should be encouraged in cooperation with State authorities.

5. Expanded and intensified participation in rural area and rural-urban planning. The Department should make its services available to State and local planning groups in achieving appropriate development and use of land and water resources in rural areas and desirable patterns of rural residence. Information and consultation should be provided on soils and their suitability; watershed program and land management possibilities; rural zoning and related regulations; technical assistance in accomplishing land-use shifts; and means for encouraging proper land-use and treatment practices. Emphasis should be placed on coordinating plans at farm, area, State and regional levels of participation in order that each level be an integral part of the broader program. Comprehensive rural renewal programs should be undertaken in areas of serious maladjustment.

Department representatives should cooperate with State and local authorities and make the services of specialists available in the interests of promoting the orderly development and use of land and water resources in areas where urban expansion is occurring.

6. Prevention of resource contamination. Action in cooperation with other agencies should be expanded to identify pollution hazards to agriculture from other sectors and from agricultural chemicals and farming practices; and preventive measures developed, including the application of safeguards and improved technologies.

7. Improved fish and wildlife habitat and expanded recreational enterprises. Increased incentives and technical assistance should be provided to private landowners for managing their lands to preserve and increase wildlife, and promote recreational development and other noncrop uses. Technical and financial assistance should be provided to States and local agencies in planning and developing public recreation, forests, game management areas, and hunting grounds.

8. Improved rural environment and natural beauty. Land and water resource development and management programs should place greater stress on providing an attractive rural environment, including natural beauty, healthy and pleasant surroundings, opportunities for leisure and esthetic experience and other amenities.

9. Utilization of all resources and authorities of the Department.

The Department should fully utilize its available resources and authorities to facilitate desirable resource and human adjustments; and seek additional authority where needed. Credit for housing, water supply, recreation facilities, waste disposal, fire control, and electrification and communication services should be provided to encourage desirable patterns of rural living, to stimulate rural commerce and industry, promote rural renewal, and other ways sought to assist in increasing farm and nonfarm employment and income.

10. Participation in planning at all levels. Local citizens should be informed of issues and encouraged to participate effectively in the planning and implementation of programs through strong local organizations. National, regional, and local programs should be integrated, and all should reflect national needs and goals.

11. Equitable distribution of costs. The costs of land and water production adjustment and development programs should be shared equitably in accordance to benefits accruing to such interests as producers, consumers and the general public.



PART II. PREVAILING AND POTENTIAL RESOURCE  
SUPPLIES AND REQUIREMENTS

The Resource Base

Land Area

The total land area of the United States is approximately 2,271 million acres. The area of the contiguous States is 1,902 million acres, while Alaska and Hawaii contain about 369 million acres.

A number of factors affect the adequacy of land resources in meeting man's various use requirements. These factors include climate, relief, soil and location with respect to population centers and transportation.

The Nation's land mass is characterized by wide variations in physical and climatic features. Physical features range from the gently sloping Coastal Plain along the Atlantic Seaboard and the plateaus, ridges, and valleys of the Eastern Highlands, through the vast rolling interior plains to the high and wide mountain ranges and valleys of the West.

Wide variations prevail in temperature and precipitation. Temperature is the main climatic variant from North to South. It ranges from the Arctic temperature of northern Alaska through temperate and sub-tropical zones in the contiguous States and Hawaii. From East to West, the main climatic variant is precipitation. East of the one-hundredth meridian, precipitation is generally sufficient for successful crop production. Dryland crop production west of that meridian becomes more hazardous. In most of the valleys of the West, irrigation becomes essential for crop production. Exceptions include the high precipitation of the Coast Range and Cascade Mountains of the Pacific Northwest. Alaska and Hawaii are also characterized by extremely variable precipitation patterns. The great bulk of the land area contributes to meeting man's needs. Its capacity has been sufficient to provide an abundance of food and fiber and afford adequate space for living and recreation. The availability of an abundant supply of usable land has contributed to a level of living that is high beyond precedent. About 12 percent of the land area, mainly desert, bare rock, swamp and related types, is considered to be of limited economic value.

Capability Classes of Non-Federal Rural Land

The Nation's land varies widely in its capability for various uses. Some soils can be cultivated safely with only minimum precautions to maintain or improve productivity. Others can be cultivated regularly if proper conservation measures are used and some can withstand only occasional or limited cultivation even with intensive conservation practices. Still other kinds of soil are generally unsuited to cultivation and need to be kept in permanent vegetation.

### The Land-Capability Classification

The land-capability classification is an "interpretive grouping" of soils made primarily for agricultural purposes. The classification covers all rural land in non-Federal ownership in the 50 States, which totals 1,451,428,000 acres. The broadest category in the land-capability classification places all the soils in eight land-capability classes. The risks of soil damage from cultivation and the limitations on agricultural use become progressively greater from class I to class VIII. Soils in the first four classes are capable under good management of producing adapted cultivated field crops, pasture or range plants, forest trees, or other adapted plants. Soils in classes V, VI, and VII are suited to the use of adapted native plants. Some soils in classes V and VI are also capable of producing specialized crops, such as certain fruits and ornamentals, and even field and vegetable crops under highly intensive management involving elaborate practices for soils and water conservation. Soils in class VIII do not return onsite benefits for inputs of management of crops, grasses, or trees without major reclamation.

Land-capability classes are defined in terms of specific soil properties and other conditions applicable to each survey area. The land capability classification may be changed when major reclamation projects are installed that permanently change the limitations in use or reduce the hazards or risks of soil or crop damage. Examples include major drainage, levees or flood-retarding structures, irrigation, removing stones, or large-scale grading of gullied land.

The capability classification is based on current knowledge about the use and management of soils which is continually subject to change with the progress of research and experience. Brief definitions of the classes are given in table 1, with more detailed discussion of each class presented in Appendix A.



Table 1.--Definitions of land-capability classes

Land generally suited for cultivation, pasture, range, woodland, or wildlife	:	Land generally not suitable for cultivation but suitable for other uses
<u>Class I</u> --These soils have few or no conditions that limit their use. They can be safely cultivated without special conservation treatment.	:	<u>Class V</u> --These soils have little or no erosion hazard but have some condition impractical to remove that limits their use largely to pasture, range, woodland, recreation, water supply, or wildlife food and cover.
<u>Class II</u> --These soils have some natural condition that limits the plants they can produce or that calls for some easily applied conservation practice when they are cultivated.	:	<u>Class VI</u> --These soils have severe limitations that make them generally unsuited for cultivation and restrict their use largely to pasture, range, woodland, recreation, water supply, or wildlife food and cover.
<u>Class III</u> --These soils have more serious or more numerous limitations than those in class II. The limitations may be natural ones, such as steep slope, sandy or shallow soil, or too little or too much water. Or the limitation may be erosion brought on by the way the land has been used. Thus they are more restricted in the crops they can produce or, when cultivated, call for conservation practices more difficult to install or keep working efficiently.	:	<u>Class VII</u> --These soils have very severe limitations that make them unsuited for cultivation and that restrict their use to pasture, range, woodland, recreation, water supply, or wildlife food and cover with careful management.
<u>Class IV</u> --These soils have very severe limitations that restrict the plants they can grow or the number of years they will produce a cultivated crop. When cultivated, they require very careful management. In humid areas, they are suitable for occasional but not regular cultivation; in sub-humid and semiarid areas, crops fail in low-rainfall years.	:	<u>Class VIII</u> --These soils and land forms have limitations that prevent their use for commercial plant production and that restrict their use to recreation, water supply, or wildlife food and cover with careful protection.

Land in Capability Classes Suitable for  
Regular or Occasional Cultivation

More than two-fifths of the total non-Federal rural land, or 638 million acres, is potentially suitable for regular cultivation. This comprises land in capability classes I through III (table 2). The land suitable for regular cultivation is concentrated principally in the Corn Belt, Mississippi Delta, and Northern Plains regions. The Intermountain, Pacific, and Northeast regions have the lowest proportions of land suitable for cultivation.

Table 2.--Land capability classes by land use for 50 States for non-Federal, non-urban land 1/

(Thousand acres)					
Class	Cropland	Pasture and range	Forest and woodland	Other	Total
I	27,435	3,940	3,573	1,247	36,195
II	192,923	42,851	43,426	11,279	290,479
III	152,970	66,602	77,910	13,854	311,335
I - III	373,328	113,393	124,909	26,380	638,009
IV	48,993	53,938	58,413	7,838	169,181
I - IV	422,321	167,330	183,322	34,218	807,190
V	1,773	10,525	28,920	1,832	43,051
VI	17,940	166,288	88,490	4,995	277,712
VII	5,636	138,690	144,227	7,682	296,233
VIII	66	2,523	6,518	18,136	27,242
V - VIII	25,415	318,025	268,154	32,645	644,238
Total <u>2/</u>	447,736	485,356	451,476	66,863	1,451,428

1/ Estimates from the National Inventory of Soil and Water Conservation Needs made as of 1958. Because of rounding to thousands, the total of items listed may not coincide with the total shown.

2/ Does not include 1,445,000 acres of unclassified land.



Nearly three-fifths of the soils suitable for regular cultivation are being cultivated. The remaining 265 million acres suitable for cultivation are presently being used for pasture, woodland, or other noncultivated crop uses. Such uncultivated but suitable land is most prevalent in the Southeast, Mississippi Delta, and Appalachian regions. Much of this acreage would be available if needed for cultivated crops, although many operating farm units will continue to use some of this kind of land for pasture and woodland.

Many of these acres potentially suitable for regular cultivation now growing grass or trees would require substantial investments for clearing, draining, or other land improvements to fit the soils for cultivation. Moreover, much of this land is inconveniently located or occurs as small or irregular areas which cannot be used efficiently with modern machinery. Thus, it would be uneconomical to bring all of the 265 million acres into cultivation. An estimated additional 169.2 million acres is in class IV and is suitable only for occasional or limited cultivation. Each of the major uses accounts for around one-third of the land in this class. When cultivated, such land requires very careful management, and conservation practices are more difficult to apply than on soils in classes II and III.

#### Land-Capability Classes Generally Not Suitable for Cultivation

About 44 percent of the non-Federal rural land in the United States, or 644.2 million acres, is generally not suitable for cultivation (classes V to VIII). Almost half (49 percent) of this land is used for pasture and range, about two-fifths (42 percent) for forest and woodland, 4 percent for cropland, and 5 percent for other uses. The Northeast, Mountain, and Pacific regions have the highest proportions of this kind of land.

More than 25 million acres of land in classes V to VIII were being used for cropland in 1960. More than half of this acreage is in three regions--the Northern Plains, Corn Belt, and Mountain. Most of this land should be shifted out of cultivation into other uses, although under extra special management some of it can be used safely for cropland.

This problem acreage makes up 1.8 percent of the total non-Federal rural land. In contrast, 2.4 percent of the class V to VIII non-Federal land is being used for cropland in the Great Plains (Northern Plains and Southern Plains regions combined), or 9.2 million acres.

Progress is being made in shifting unsuitable cropland to other uses. During the past 5 years, cropland of all classes has been converted to grass at the rate of 2 to 2.5 million acres per year. An additional one-third to one-half million acres has been converted annually to trees and shrubs.

# Forest Resources

## Forest Land Base

After more than three centuries of settlement and development, forests in this country still occupy about one-third of the Nation's land area, or about 760 million acres (table 3). Commercial or primarily timber-producing land makes up about 70 percent of the total. The remainder, or noncommercial, generally refers to lands suited primarily for watershed and scenic values and includes nearly 30 million acres set aside for exclusive use, such as National Parks or primarily so as in National Forest Wilderness areas. About one-half of the total forest land area and nearly nine-tenths of the noncommercial forest area is found in the West. The preponderance of commercial forest land lies in the East, split about equally between the North and South.

Table 3.--United States forest land area, 1963 <sup>1/</sup>

Section	Commercial	Noncommercial	Total
	- Million acres -		
North -----	171.8	6.6	178.4
South -----	201.1	19.2	220.3
West -----	129.1	110.6	239.7
Total - 48 States:	502.0	136.4	638.4
Alaska and Hawaii :	6.9	<sup>2/</sup> 113.6	120.5
Total - 50 States:	508.9	250.0	758.9

<sup>1/</sup> Source: Timber Trends in the United States, 1965.

<sup>2/</sup> Part of this area in Interior Alaska will meet standards for commercial forest land but detailed data are not available.

Most of the forest land is devoted to more than one use. It furnishes about 9 percent of the wood consumed in this country. It harbors most of our large game and other wildlife and affords an indispensable backdrop and a majority of key sites for outdoor recreation activities. The bulk of the waterflow originates on forest land. These lands provide forage for domestic livestock where a few months' feed is essential to a year-round operation. Mineral exploration, discovery, and extraction coincide more often than not with mountainous and mostly forested land.

About half of the forest land is publicly owned and half is privately owned. The area is divided about evenly between softwoods and hardwoods, with hardwoods concentrated almost exclusively in the East. Only about 50 million acres of virgin old-growth remain of a once vastly



forested empire. Cutting, fires, attacks by insects and disease, and other acts of nature have left the remainder in various stages of productivity. Of the total forest land, over 100 million acres support only a partial stand of trees, including 35 million acres which are essentially devoid of tree cover.

Much of the timber-producing area is not yielding its full potential of desirable species or quality of the kind needed by industry. Nearly one-fifth of the hardwood timber volume and about one-tenth of the volume of all trees is cull. These cull trees are considered unmerchantable. They occupy spaces that should be growing desirable trees.

Much of the forest area, particularly in the East, supports a preponderance of small trees. Many stands contain a high proportion of low-grade material (other than culls)--trees of poor form, knotty, and otherwise defective--especially in hardwood stands. Likewise, desirable species are losing ground to undesirable species in far too many of the stands in the East.

Substantial volumes of timber in remote areas of the West, and in scattered trees in the East, cannot be profitably logged today because of problems of accessibility and low volumes per acre. As a result, many wood-using industries, particularly those dependent on hardwoods, are experiencing increasingly greater difficulty obtaining the desired sizes and quality of preferred species.

Destructive agents--fire, insects, disease, adverse weather, and other factors such as overcrowding--cause an annual mortality of about 19 billion board feet of timber. Additional loss is caused by retarded growth rates because of attacks by insects, disease, dwarf mistletoe, and delay in restocking burned areas. Such impacts may well exceed the volume of mortality.

Premature harvest contributes heavily to a lowering of the net annual growth on the lands of farmers and other small ownerships. Cutting timber before it reaches financial maturity causes the owner to lose much additional income, produces a lower quality raw material for industry, and a poorer product for the consumer.

Resource values have suffered as a result of abuse and misuse of forest land. Small trees instead of large, poor species in place of preferred species, and defective or otherwise poor quality timber in place of high quality trees is the rule rather than the exception over much of our most productive forest land. Misuse and abuse of watershed lands has increased erosion and storm runoff resulting in silt-laden streams and erratic flows.

## Ground and Surface Water Supplies

The total annual volume of water removed from the oceans and transported as atmospheric moisture over the continental United States is estimated to approach 150 inches per unit area of the land surface. About one-fifth of this on the average, or 30 inches per unit area, reaches the ground as rain or snow. Annual precipitation ranges from over 150 inches at a few coastal weather stations in Alaska to less than 4 inches in parts of Arizona, California, and Nevada. The total volume of precipitation for the 48 contiguous States has been calculated as about 4.75 billion acre feet, and is a gross measure of our renewable water resources (table 4).

Table 4.--Estimated current water supplies in the United States, including Alaska and Hawaii 1/

Supply item	:Billions : : of : :acre feet:	Equivalent : : inches per- : : unit area :	Percent : : of : : precipitation
Annual precipitation supply----	4.75	30	100
Annual onsite use <u>2/</u> -----	3.38	21	70
Annual runoff or streamflow supply <u>3/</u> -----	1.37	9	30
Net ground-water stock <u>4/</u> --	47.50	277	--
Ground water as years of runoff:	35 years	--	--

1/ Unless indicated otherwise, data are from Edward A. Ackerman and George O.G. Lof in Technology in American Water Development. Johns Hopkins Press, Baltimore. 1959, p. 51.

2/ Includes direct evapotranspiration in forest and nonirrigated agricultural crop production, livestock production, ground water recharge in upstream areas, and other upstream uses.

3/ Supply available for downstream withdrawal or nonwithdrawal uses at points below at least a 1,000 square-mile drainage area.

4/ It has been estimated that the net quantity of ground water of the 48 States is roughly equivalent to 10 times the average annual volume of precipitation. See: A. M. Piper, "The Nationwide Water Situation," The Physical and Economic Foundation of Natural Resources: IV, Subsurface Facilities of Water Management and Patterns of Supply, House of Representatives Interior and Insular Affairs Committee, Washington, D. C., Govt. Print. Off., 1953, p. 15.



About 3.38 billion acre feet, or 70 percent, of the total annual precipitation evaporates from soil and water surfaces or is transpired by nonirrigated vegetation. This is commonly referred to as onsite use. Regional variations in this percentage are associated with many factors--primarily climate, topography, the nature of the vegetative cover, kind of soil, nature of rainfall, and land-use practices. The remaining 1.37 billion acre feet of precipitation may either reach stream channels almost immediately to become streamflow or recharge underground aquifers.

Natural runoff varies from mere traces in the extremely arid areas of the West, to 40 inches per year in the eastern Tennessee Valley and up to 80 inches or more in parts of the Pacific Coast rainbelt. For some high-elevation areas of southeastern Alaska, annual runoff has been calculated to exceed 300 inches. The national average runoff is 9 inches. The 1.37 billion acre feet of runoff is a general measure of the average annual supply of water available for direct withdrawal, or for such flow uses as navigation, power generation, recreation, fish-wildlife habitat, and waste dilution.

Net ground-water stocks are another important but nonrenewable component of water supply. Net stocks of all ground water in the United States, some of which are inaccessible economically, are estimated to be over 47 billion acre feet. This is equivalent to about 35 years of average runoff.

#### Present Resource Uses

A fifth of the land area of the United States is used as cropland, including cropland that is pastured (table 5). Over one-fourth is in open permanent pasture and range. One-third of the total area is forested, and about one-third of the forested area is grazed. Including the forest land used for grazing, about three-fifths of the land area is in crop and livestock production. If all forest land is included, about four-fifths of the total land area is used for agriculture.

The balance of about one-fifth is in various nonagricultural land uses. Between 2 and 3 percent of the total land area is devoted to urban and related intensive uses. The primary use of from 4 to 5 percent is recreation or wildlife, and public installations and facilities. The remaining one-eighth is mainly desert, bare rock, swamp, and other land of limited economic use.

#### Agricultural Land

Agricultural uses include cropland, open permanent pasture and range, forest land and farmsteads and farm roads.

Table 5.--Land utilization: United States, 1959

Major use	48 contiguous States		All 50 States	
	Mil. ac.	Pct.	Mil. ac. <sup>1/</sup>	Pct.
Agricultural:				
Cropland-----	457	24	458	20
Crops and related uses <sup>2/</sup> -----	(391)	(21)	(392)	(17)
Used only for pasture-----	(66)	(3)	(66)	(3)
Pasture (excluding cropland				
pasture)-----	<sup>3/</sup> 630	33	633	28
Forest land <sup>4/</sup> -----	614	32	732	32
Commercial-----	(502)	(26)	(509)	(22)
Noncommercial-----	(112)	(6)	(223)	(10)
Farmsteads, farm roads-----	10	1	10	( <sup>5/</sup> )
Total agricultural land-----	1,711	90	1,833	80
Nonagricultural:				
Special-purpose uses-----	129	7	147	7
Urban and other built-up areas:	(53)	(3)	<sup>6/</sup> (54)	(3)
Areas limited primarily to				
recreation or wildlife use--	(47)	(2)	(62)	(3)
Forest land <sup>4/</sup> -----	(25)	(1)	(27)	(1)
Nonforest-----	(22)	(1)	(35)	(2)
Public installations and				
facilities-----	(29)	(2)	(31)	(1)
Miscellaneous land-----	62	3	291	13
Total nonagricultural land--	191	10	438	20
Total land area-----	1,902	100	2,271	100

<sup>1/</sup> Acreages rounded to nearest million. Cropland acreage reported by Bureau of Census and adjusted upward to compensate for under-enumeration.

<sup>2/</sup> Cropland harvested, crop failures, and cultivated summer fallow, soil improvement crops, and idle cropland.

<sup>3/</sup> Open permanent pasture and range in the 48 contiguous States comprises 473 million acres and 157 million acres Federal grassland range used for grazing.

<sup>4/</sup> Includes forested grazing land or range, including Federal forest range used by permit. The combined acreage of forest land including areas limited primarily to recreation or wildlife use (the 25 and 27 million acres shown under special-purpose uses and embracing reserved forest land in parks, wildlife refuges, wilderness, and related areas) totals 639 and 759 million acres in the 48 and 50 States respectively.

<sup>5/</sup> Less than 1 percent.

<sup>6/</sup> Rounding to the nearest million accounts for part of the difference between totals for the 48 States and 50 States.



## Cropland

The total cropland acreage is composed of five types of cropland uses: (1) Cropland harvested; (2) crop failure; (3) summer fallow; (4) idle and soil improvement crops, neither pastured nor otherwise harvested; and (5) cropland used for pasture. The first three of these subclasses--cropland harvested, crop failure, and summer fallow--together are referred to as cropland used for crops since they include all the land either being prepared for crop production or planted to crops intended for harvest. The total value of crop production has averaged around \$20 billion annually in recent years. Corn, cotton, wheat and hay account for more than one-half the total value of crops produced.

From a peak of 482 million acres reached in 1934, total cropland declined to an estimated 458 million acres by 1959. A significant decrease of 18 million acres in the late 1930's and early 1940's was substantially offset by an increase of 14 million acres just prior to 1949. From 1949 to 1959 the total acreage of cropland has declined approximately 20 million acres (table 6).

Table 6.--Use of total cropland, 1949 to 1959

(Million acres)				
Land use	1949	1954	1959	
Cropland harvested-----	352	339	317	
Crop failure-----	9	13	11	
Cultivated summer fallow-----	26	28	31	
Total cropland used for crops-----	387	380	359	
Soil improvement and idle cropland----	22	19	33	
Cropland used for pasture-----	69	66	66	
Total-----	478	465	458	

From 1920 to the present, cropland used for crops has ranged from a 1949 high of 387 million acres to a low of 330 million acres in 1962, the smallest acreage since 1910. As late as 1954, 380 million acres of cropland were used for crops, and the substantially lower acreages since then are largely the result of government programs designed to withdraw land from crop production. From the peak of 387 million acres in 1949 until the first year of the Soil Bank Program in 1956, cropland used for crops declined only moderately. Between 1955 and 1960, land used for crops declined by 23 million acres. The acreage in cropland used for crops has been further reduced with the more recent Feed Grains and Wheat Programs. The acreage of cropland used for crops declined moderately in 1960 and fell sharply in 1961. By 1962, the acreage used for crops had declined to 330 million acres, the smallest acreage so used since 1910.

In 1963, the acreage of cropland used for crops increased by approximately 6 million acres over 1962 (table 7). This increase, the first since 1959, was due in part to the release of Conservation Reserve lands and somewhat reduced participation in other supply management programs.

Table 7.--Cropland used for crops, 1960 to 1963

(Million acres)				
Type of cropland	1960	1961	1962	1963
Crops harvested-----	(324)	(303)	(295)	(300)
Double cropped-----	(7)	(7)	(7)	(7)
Cropland harvested-----	317	296	288	293
Crop failure-----	7	12	11	12
Cultivated summer fallow-----	31	31	31	31
Total cropland used for crops---	355	339	330	336

The acreage of cropland used only for pasture has been relatively stable over a long period. In 1929, there were 67 million acres of land so classified. During World War II, cropland used only for pasture declined to 61 million acres, but increased to 69 million acres by 1949. In 1954 and 1959, the last year for which data are available, 66 million acres of cropland were used only for pasture.

#### Pasture and Range

Grazing is the largest single use of agricultural acreage, and pasture and range are important resources in the agricultural economy. Pasture and range furnish nearly 49 percent of the annual feed units consumed by cattle and sheep. In 1962, cash receipts from farm marketings of cattle, sheep, dairy products and wool exceeded \$13.4 billion and represented about 37 percent of total cash receipts.

About 944 million acres of the Nation's land resources are used as pasture and range, including 66 million acres of cropland used only for pasture, 633 million acres of permanent open pasture and range, and 245 million acres of grazed forests and woodlands (table 8). Hawaii and Alaska combined, currently have less than 6 million acres of land used for pasture and range.

The total acreage of land used as pasture and range has decreased by over 100 million acres since 1940. Most of this decrease has occurred in the amount of forests and woodlands grazed, since acreages of cropland used only for pasture and open permanent pasture and range have remained relatively stable.



Table 8.--Trends in pasture and range, 1920 to 1959

(Million acres)							
Type	Conterminous States				1959		
	1920	1930	1940	1950	48 States	50 States	
Cropland used only for pasture-----	78	67	68	69	65	66	
Open permanent pasture open range <u>1</u> /-----	652	652	650	631	630	633	
Forest and woodland grazed <u>1</u> /-----	336	323	347	320	243	245	
Total pasture and range-----	1,066	1,042	1,065	1,020	938	944	

1/ Acreages for 1920, 1930, and 1940 do not agree with earlier published acreages due to an adjustment in historical data made in 1961.

Of the open permanent pasture and range, about three-fourths is in private and other non-Federal ownership, with about one-fourth being Federal range. The ownership of two-thirds of the grazed forests and woodlands is non-Federal, and one-third is Federal. Almost all of the cropland acreage used only for pasture is non-Federally owned.

Among the different types of pasture and range, cropland used only for pasture produces by far the most forage per acre. It has been estimated that an average acre of cropland used for pasture produces 5 to 6 times as much as an acre of permanent grassland pasture (private and other non-Federal pasture in farms), and 25 to 30 times the feed from an acre of unimproved woodland pasture or Federal range.

The condition of both privately owned and public rangelands and pastures varies widely. Not more than 30 percent of all privately owned rangeland is estimated to be in good or excellent condition. The remaining 70 percent is in fair or poor condition. The productivity of most of this land could be raised considerably. The publicly owned rangelands on the average produce one-half or less of their grazing potential and fall short of the demands for livestock and wild game grazing.

Range site and condition surveys have been made on 155 million acres of privately owned rangelands. Surveys are being completed at the rate of 15 million acres a year. The owners of these rangelands, as cooperators with soil conservation districts, have developed basic conservation plans. Such a plan includes: (1) A conservation plan map which contains information on ownership boundaries and range site and condition; and (2) the cooperator's decisions as to what treatments he intends to use in improving and conserving grazing and other resources.

Similar range condition and trend surveys and subsequent management planning have been completed on 45 percent of the rangeland administered by the Bureau of Land Management, Forest Service, and Bureau of Indian Affairs. At present rates, all of these lands will be covered by surveys within 5 years.

Grazing on some 320 million acres of rangelands, much of it west of the 100th Meridian, has been severely reduced by the invasion or increase of low-value trees and shrubs, such as mesquite, juniper, sagebrush, and oak. Such increases are often accompanied by accelerated erosion.

### Forest Land

The 759 million acres classed as forest land are used to produce many and varied products and services. Around 531 million acres, or about 70 percent of the forest area, is commercial forest land. This acreage is suited for the production of timber, pulpwood, naval stores and miscellaneous forest products. The noncommercial forest land totals 236 million acres and for various reasons is considered unsuited for the production of commercial timber crops. Limitations and constraints include unfavorable environmental conditions that adversely affect growth and quality, physical inaccessibility, or areas withdrawn or reserved to serve other purposes. Both types of areas are capable of providing forage, wildlife habitat, watershed protection, scenic and esthetic attractions and a variety of recreational pursuits.

Timber use.--Timber production is one of the most extensive uses of forest land, and a major factor in the national economy. In recent years, the value of timber harvested equaled about 14 percent of the value of all farm crops harvested, about equal to the value of wheat, and greater than the value of cotton. The harvest value of timber has only been exceeded by the value of corn.

The volume and manner of timber cut are important measures of resource use. In recent years this volume has exceeded 10 billion cubic feet annually. Of this total, 82 percent comes from sawtimber, a demonstration of how heavily the national harvest leans on the larger sawtimber size trees.

About 68 percent of the sawtimber harvested is cut for lumber. Even for products that do not require trees of sawtimber size, much of the cut is taken from sawtimber size trees. For example: pulpwood, 56 percent; fuelwood, 52 percent; fence posts, 34 percent; and round mine timbers, 30 percent.

Softwood sawtimber is the backbone of the timber industry. About 80 percent of the sawtimber inventory and roughly 80 percent of all timber produced are softwoods. From a geographical standpoint, the lands in the West supply about 72 percent of the softwood sawtimber cut.



The West leads in timber cut for sawlogs and veneer; the South leads in the harvest of pulpwood and fuelwood. In the North, hardwoods are in greater abundance and the cut is largely for hardwood sawlogs and veneer.

Domestic timber resources still supply the great bulk of material consumed by the U.S., yet growing imports indicate we will continue to be a net importing Nation in timber products. For example, today we import nearly half the wood used in hardwood plywood and veneer--a forceable reminder to look to the quality of our timber growth and inventory rather than to the volume alone.

Other forest land uses.--Maintaining the forest in good condition as a strong base for timber production generally has corollary benefits with respect to other forest resources. Healthy vigorous forests provide the kind of environment most highly prized by forest recreationists. Keeping the forest productive for timber may also enhance its value for watersheds. Forest lands under a program of multiple-use management may also enhance conditions for fish and wildlife, recreation, natural beauty, and forage for livestock.

Outdoor recreation exemplifies in part how these other important uses are growing. Recreation use of the National Forests, for example, has climbed about three and one-half times during the past decade and by the end of the Century is projected to levels seven times that of 1960. Actual use is already running ahead of the estimates.

Recreational use of public and private forest lands now totals more than 600 million visits annually. The people making these visits--the picnickers, campers, fishermen, hunters, and all the rest--put into the trade channels several billion dollars a year for sporting equipment, transportation, lodging, and other items.

Ski slopes, campgrounds, picnic sites, hiking trails, scenic, and historic sites are being developed more rapidly than ever before to meet the rising demand for outdoor activity on forest lands. On the many private forest lands similar activity and potential exists. Skiing capacity in the Northeast, for example, was increased 25 percent in 1962 by the construction of new facilities, largely on private forest land.

As reservoirs of upland game, forests are of particular value for hunting and enjoyment of wildlife. Fishermen, too, find much of their sport originating in the thousands of miles of streams and rivers dissecting the Nation's forested watersheds.

Protection and maintenance of wilderness is another beneficial use of forest land to assume major proportions in recent years. The National Forest Wilderness System, for example, provides 88 undeveloped areas totaling more than 14 million acres of land, forest, and water which are typical of wilderness America. The national parks and some State parks provide many other areas of striking scenic beauty and unique

wilderness recreational value increasingly sought by the outdoor public. On national park back country areas and National Forest wilderness, primitive, and canoe areas use in 1960 exceeded 2.8 million man-days. In 1963 estimated use of National Forest Wilderness System areas alone was almost as great.

Wildlife use of forest land is closely associated with outdoor recreation. On lands of the Fish and Wildlife Service, on the 186 million acres of National Forests and Grasslands, and on some 500 million acres of public domain land, as well as numerous State parks and forests, wildlife is managed as a natural resource.

Use of the wildlife resource can be gauged in part by the hunting and fishing pressure of recent years. Since 1949, hunting and fishing on the National Forests, for example, has increased 8 times faster than the nationwide rate of hunting and fishing license sales.

Estimates of sport fishing in the U.S. indicate a 17-percent increase between 1955 and 1960. One in every four men hunted wild game in 1960. About two-thirds of these hunters are after small game and another third seek big game.

The major potential for meeting wildlife conservation and production needs of the future rests with private landowners. The private lands of the Nation provide 80 percent of the game taken by hunting and access to much of the fishing. The trend among private landholders toward posting against trespass has so increased the need to develop adequate access for public hunting and fishing it has become a major requirement in planning for the future.

Forest lands include many of the most important watersheds in the Nation. What happens to forest land therefore has a direct bearing upon the amount and character of the water supply. Undisturbed forest cover provides optimum conditions for introduction and retention of water in the earth's soil mantle.

With growing population pressure for expanding needs forested watersheds face even greater use as collection basins, purifiers, and regulators of water. Watershed lands are coming to be used more and more for other purposes at the same time enlarged water use is demanded of them. Increasingly, local water supplies are more than matched by new demands placed on them for additional water quality, withdrawal, and consumption.

About 245 million acres of forest land are grazed to some degree each year. Pine forests in the South, open coniferous forests in the West, and woodland in the Southwest are of primary importance for seasonal livestock use. While grazing occurs on hardwood forests, studies indicate that livestock use in most cases is not compatible with hardwood timber production.



## Nonagricultural Land

The Nation's growing population is requiring an increasing amount of land for residential and industrial purposes, and for numerous types of public facilities. Along with increases in population, increases in income and leisure time and economic growth, have all contributed to an expansion in nonagricultural land requirements. The shift to nonagricultural uses during the last decade has been at a rate of about 2 million acres annually.

Land in cities and towns, rural highway and road rights-of-way, railroads, airports, and public institutions in rural areas, increased from about 32 million acres in 1920 to approximately 54 million acres in 1959. During the 1950's, the average rate of absorption of rural land by these uses was about 1 million acres a year. Slightly over half of this, or 550,000 acres, are estimated to have gone into urban use. Highways, roads, airports, and other rural public facilities absorbed the rest, or an estimated 450,000 acres.

There has been a similar increase in the amount of rural land absorbed by nonagricultural special uses, including Federal and State parks and other rural parks, recreational areas, wildlife refuges, national defense sites, flood-control areas, and Federal industrial areas. From 1920 to 1959, the acreage of land devoted to these non-agricultural uses increased from 28 million acres to nearly 61 million acres in the 48 States. This does not include the 25 million acres of reserved forest land which is in parks, wildlife refuges, and wilderness areas. Alaska adds approximately 17 million acres to the amount of land in nonagricultural special use areas, mostly in the form of rural parks and wildlife areas. During the 1950's, nonagricultural special-use areas also increased at the rate of about 1 million acres a year.

Thus, a total of roughly 2 million acres of rural land annually were shifted from agriculture, forestry, and other rural uses to non-agricultural uses during the decade of the 1950's. The prior use of most of this land was pasture, range, forest or idle. Land converted to urban, highway, airport, or reservoir uses, however, involved considerable cropland. It has been estimated that of the 2 million acres diverted per year from rural uses between 1950 and 1959, approximately 40 percent was from cropland and grassland pasture, 40 percent from forest, and 20 percent from idle land.

In addition to the urban and other special uses of land discussed above, there are about 62 million acres in the 48 conterminous States and 291 million acres in 50 States which are not used for crop and forage production or forestry. Included among these acreages are limited miscellaneous areas such as reservoirs, industrial and commercial sites in rural areas, mining and quarry sites, powerline rights-of-way, cemeteries, and golf courses. Also included are extensive areas of inherently physically unproductive lands such as barren rocks, desert, swamps, dunes, etc. Such unproductive land has some utility for wildlife and recreational use and potential value for the production of minerals.

## Water Uses

Precipitation as the total annual water supply is initially used either onsite or runs off as streamflow. About 70 percent of the precipitation supply is used at or near its point of origin to sustain vegetative cover or as ground water recharge; while 30 percent becomes annual runoff or streamflow.

### Onsite Water Use

Most of the onsite water use occurs on land that produces vegetation of economic value in the form of either nonirrigated farm crops and pasture, or forest and browse. There are some other areas where all or a part of the vegetation is of little or no economic value. For example, in some of the arid or semi-arid areas phreatophytes or unpalatable vegetation use water of far greater value than the economic or esthetic worth of such vegetation. Thus, there is a need in such areas to replace some of the undesirable and unproductive vegetation with more desirable species.

In arriving at decisions concerning possible controls of onsite evapotranspiration and corresponding water yields, consideration must be given both onsite and downstream uses and values of water, including damages associated with erosion, flooding, and water quality impairment. Alternatives to be appraised include leaving the area unchanged, altering the extent and type of vegetation, or establishing structures and practices to control amounts and rates of runoff.

### Uses of Streamflow and Ground Water

Of the 1.37 billion acre feet of runoff or streamflow available in the 48 contiguous States estimates indicate that about 267 million acre feet of water is withdrawn from streams. An additional 20 million acre feet is mined from ground-water stocks--for a total annual withdrawal of 287 million acre feet. This is equivalent on a per-capita basis to about 1,425 gallons daily. In addition, about 2.25 billion acre feet of water is run through hydropower generation facilities.

In recent years, about 37 percent, or 107 million acre feet, of the water withdrawals were for agricultural purposes (table 9). Of this, about 103 million acre feet were for irrigation, with 4 million for livestock watering and rural domestic purposes. The acreage utilizing the irrigation water withdrawals accounts for about 20 percent of the aggregate national value of crop and pasture production.

Although agricultural withdrawals increased by about three-fifths between 1940 and 1960, the relative importance of agricultural withdrawals has been declining. Total withdrawals have more than doubled over the last two decades, and the proportion withdrawn by agriculture has dropped from over one-half to less than two-fifths.



Table 9.--Trends in major withdrawal uses of water between 1940 and 1960 in the United States, excluding Alaska and Hawaii 1/

Withdrawal and consumptive use items	: 1940	: 1945	: 1950	: 1955	: 1960 <u>2/</u>
Agricultural withdrawals: <u>3/</u>					
Withdrawals, million acre feet-----	67	76	90	98	107
Average 5-year percent increase-----	--	13	18	9	9
Percent of all withdrawals:	52	48	47	41	37
All withdrawals: <u>4/</u>					
Withdrawals, million acre feet-----	129	160	192	240	287
Average 5-year percent increase-----	--	24	20	25	20

1/ Based on analysis of the following sources: (1) U.S. Department of the Interior, Geological Survey Circulars 115, 398, and 456, Estimated Use of Water in the United States, 1950, 1955, 1960, by K.A. MacKichan (Cirs. 115 and 398) and K.A. MacKichan and J.C. Kammerer (Cir. 456). (2) Walter L. Picton, Water Use in the United States, 1900-1980, U.S. Department of Commerce, Business and Defense Services Administration, March 1960. (3) Various Census of Agriculture reports dating from 1940-1959, U. S. Department of Commerce, Bureau of the Census. (4) Report of the Secretary of the Interior to the U.S. Senate Select Committee on National Water Resources, 86th Cong., 2d sess., Committee Print No. 14, Future Needs for Reclamation in the United States, Wash., D.C., Govt. Print. Off., 1960. (5) Hugh H. Wooten, Karl Gertel, and William C. Pendleton, Major Uses of Land and Water in the United States, U.S. Department of Agriculture, Economic Research Service, Agricultural Information Bulletin No. 13.

2/ Estimates for 1960 based on 33.75 million acres of irrigated land as based on Census of Agriculture 1939-59 trends, and per-acre withdrawal rates of 3.87 acre feet for irrigation withdrawals from surface water sources and 2.00 acre feet for withdrawals from ground sources, and an average ground-surface withdrawal rate for 1960 of 3.05 acre feet per acre irrigated as estimated by the Geological Survey.

3/ Including uses for irrigation, livestock, and other rural domestic purposes.

4/ Excludes reservoir and pond evaporation.

The volume of consumptive use is a more significant measure of water demand than is the volume withdrawn. While withdrawing 37 percent of the total, agriculture accounts for nearly 90 percent of the total consumptive use. Such water is consumed with use and does not reappear as return flow. It is thus no longer available for subsequent withdrawal or flow uses. High rates of consumptive use are characteristic of both irrigation and other rural uses. The rate of consumptive use is about 60 percent of the withdrawals for irrigation; and about 75 percent for livestock and rural domestic uses. Consumptive use in agriculture is in contrast with urban uses where the rate is around 4 to 5 percent of withdrawals.

The overall U.S. rate of consumptive use in 1960 was about 25 percent of all withdrawals. It was about 5 percent of the average available supply from streamflows and mined ground water. Total consumptive use has about doubled over the last two decades, with agriculture accounting for over one-half of the increase.

The 1.37 billion acre feet of streamflow is an average that is available on a sustained basis no more than 50 percent of the time. The highest low flow sustainable with feasible storage possibilities fully developed would establish an upper limit on the fully dependable supply. The annual fully dependable supply potential is estimated to be about 10 percent under the average streamflow, or about 1.21 billion acre feet. Annual consumptive uses for the country as a whole amount to about 6 percent of such supply. However, the average for the Western States is about 53 percent; for the Colorado Basin, near 80 percent; and for the South Pacific and Upper Rio Grande Basins, practically 100 percent. Additional consumptive uses in the latter two regions will depend on importations from other regions and efficiency gains in prevailing consumptive uses.

When account is taken of dilution requirements to maintain water quality, the water demand and supply situation becomes more acute throughout much of the country. The combination of consumptive withdrawal uses and dilution requirements amount to almost 50 percent of the annual streamflow for the country as a whole. In most regions, increasingly serious consideration will need to be given higher levels of water treatment along with dilution as integral aspects of water resource management.

#### Trends in Irrigation Water Use and Agricultural Supply Sources

Estimates based on the Census of Agriculture indicate that about 33 million acres were irrigated in the 48 contiguous States in 1959. Hawaii adds another 141,000 acres, and Alaska only 360 acres. About 309 thousand farms practiced irrigation; and almost 93 percent of the total irrigated acreage was in the 17 Western States.

Irrigation for the Nation has increased substantially since 1939, increasing at an average rate of 750 thousand acres per year. Water withdrawals for irrigation have been increasing at an annual rate of about 2 million acre feet a year.



Since 1959 there has been a continual expansion in irrigated acreage. It is estimated that in the neighborhood of 38.5 million acres were irrigated in 1964, an increase of almost 15 percent over 1959. Although relative increases have been greater in the East, the West accounts for about four-fifths of the additional irrigated acreage.

About 70 percent of all agricultural water withdrawals are from surface sources. Irrigation is dependent primarily on surface sources, while water for livestock and households comes largely from ground sources. Irrigation from ground water relative to surface water has increased considerably since 1939. Only 17 percent of the irrigated acreage was served with ground water in 1939, contrasted with 44 percent in 1959.

The source of water for irrigation varies considerably among regions. Streams and reservoirs provide over 70 percent of the irrigation water used in the West, and about 40 percent in the East. Such sources provide about 60 percent of the withdrawals for irrigation in Hawaii.

#### Multiple Resource Uses

The resource needs for a rising level of living of a rapidly growing population can be met only through multiple use of land and water. This necessitates managing particular resources to yield the highest feasible returns or satisfactions through a combination of two or more uses.

Multiple use is already an established practice on many public and private lands. Production of crops and forage for cattle and a suitable habitat for game animals and birds occur on the same farm. Stocking of farm ponds with fish and planting of game feeds and shrubs along fence rows also have facilitated a great number and variety of uses. On a significant number of farms, a vacation enterprise that caters to city people has been combined with the regular farming operations. In addition to producing livestock and livestock products, the private and public range and pasturelands of this country also support some 10 million head of deer, elk, and antelope.

Private lands have significant existing and potential multiple uses. These lands constitute the bulk of the land area, have a wide variety of game populations, and have extensive food supply and cover suitable for wildlife. Some 80 percent of the game taken by hunting, and access to much of the fishing is provided by private lands, which usually serve other uses as well.

In addition to producing crops, livestock, forest products, fish and wildlife, the same land areas are also the watersheds that serve as collection basins, and regulators of flow for water. Improvement of cropland, pasture and forest management could benefit watershed runoff and water quality.



The principle of multiple use also has widespread application for most publicly-owned land. For some 186 million acres in the National Forest System, Public Law 86-517 specifically directs multiple use and sustained yield of all surface resources. Without this concept the Nation's forest lands would have to be much larger than they are today in order to furnish the services now being provided. Outdoor recreation exemplifies how such uses are growing. The number of National forest recreation visits reached 112.8 million in 1962, a more than tenfold increase from 1945. Ski slopes, campgrounds, picnic sites, hiking trails, scenic and historic sites are being developed more rapidly than ever before to meet the rising demand for outdoor activity.

The use of forest land for wilderness recreation has been increasing in importance in recent years. In 1963, there were 143 million acres in the Wilderness System areas in the national forests, providing many undeveloped areas typical of wilderness America. The national parks and some State parks provide many other areas of striking scenic beauty and unique wilderness recreational value increasingly sought by the public. Use in 1960 exceeded 2.8 million man-days on national park back country areas, national forest wilderness areas, and primitive and canoe areas. Estimated use of National Forest Wilderness System areas alone was more than 815 thousand visits in 1962.

In large-scale water development projects, the multiple-purpose concept has gained general acceptance. Projects are designed to serve a variety of uses such as irrigation, power generation, flood control, navigation, recreation, and municipal and industrial water supply. Similar purposes are increasingly important in the development of upstream watersheds. The economic principle for multiple water use is the same as for multiple land use, to dovetail diverse uses to the same resource base to derive the greatest feasible benefits.

Multiple water use involves not only use of the same structures, such as reservoirs and canals for a number of purposes but use of the water itself. With only a little over 20 percent of all water withdrawn from streams and ground water being consumed, and nearly 80 percent being returned mostly to streams, repeated use of the same water is widespread. In addition to streamflow regulation and dilution, water not withdrawn from streams and lakes is used for recreation, navigation, and hydroelectric power generation. Because water disposed by one user is often another user's source of supply, water quality management is a vital part of multiple water use.

#### Prevailing Tenure and Institutions

Private lands, including Indian lands, comprise 72 percent of the land area of the 48 contiguous States, and 61 percent of the land area of the 50 States. Most of the country's crop, pasture, and range production is on this land (table 10).

Table 10.--Major classes of land by use and ownership, 1959

(Million acres)											
Ownership	Cropland		Grassland pas- ture and range		Forest land		Special use and other land		Total		
	48	50	48	50	48	50	48	50	48	50	
	States	States	States	States	States	States	States	States	States	States	States
Federal-----	0.8	0.8	157.1	159.1	1/ 197.2	1/ 309.5	51.9	295.6	407.0	765.0	
State and other											
public 2/-----	1.9	2.0	40.0	40.4	33.4	34.5	43.7	44.1	119.0	121.0	
Private 3/-----	454.3	454.8	433.0	433.5	407.8	414.9	80.7	82.1	1,375.8	1,385.3	
Total-----	457.0	457.6	630.1	633.0	638.4	758.9	176.3	421.8	1,901.8	2,271.3	

1/ Includes reserved forest in parks and other special uses, and Indian forest.

2/ Excludes State grant land in process of transfer from the Federal public domain to the State of Alaska.

3/ Includes Indian cropland, pasture and range, special uses, and other land.



Federally-owned land makes up 34 percent of the land area of the 50 States. Ninety-four percent of the Federally-owned land (714 million acres) is public domain, and 6 percent (51 million acres) are public lands acquired by purchase or other means. Nearly half of the land in the public domain is in Alaska. Since transfer of Federal public-domain acres to the State of Alaska has not been completed, an estimated 100 million acres in scheduled grants are included as Federal lands.

The Federal lands are used for timber, grazing, mineral development, recreation, watershed development, and for wildlife. They are a major reserve of timber, mineral and water supply sources.

State and local governments own 121 million acres, or 5 percent of the land area. This includes State parks, wildlife refuges, recreational uses, school-grant lands under lease or permit for farming and grazing, institutional lands, watersheds, and highway rights-of-way.

#### Farmland

Ninety-two percent of all land in farms in the 48 contiguous United States is privately owned. The use of this land is decided primarily by individuals who own and operate the land. Most of the publicly owned farmland is located in the Western States and is devoted largely to grazing.

In 1959, 80 percent of the farms and 76 percent of the land in farms was operated by owner-operators, including full owners and part owners (table 11). Shifts in the distribution of tenure groups have occurred as conditions favoring certain tenure arrangements have developed. The most noticeable trend occurring in recent years is a decline in number of full tenant operators and an increase in the part-owner group, which is now the second largest tenure group. In terms of total amount of land operated, part owners have been the leading tenure group since 1954, and by 1959, they were operating 45 percent of all land in farms.

The number of full tenant-operators and land operated by them has declined sharply in the last decade. In spite of this decline, however, the proportion of farmland under lease has declined little, as renting by part owners has tended to replace renting by full tenants. In 1959, approximately 382 million acres, or a third of the land in farms, was operated under lease.

Full owners are the largest tenure group. They comprise over half of all farm operators, although they operate only about a third of the land in farms. This is explained in part by the fact that a much larger number of full-owner farms than farms in other tenure groups were part-time or residential farms.

Changes in the tenure pattern are associated with changes in the size distribution and numbers of farms, and with increased resource requirements for farming.

Table 11.--Number of farms and percentage distribution of farms and land in farms, by tenure of operator, selected years, 1940-59

Tenure of operator	1940	1950	1954 1/	1959 1/
FARMS	Number	Number	Number	Number
All farm operators--	6,096,799	5,382,162	4,783,021	3,707,973
Full owners-----	3,084,138	3,089,583	2,744,708	2,116,594
Part owners-----	615,039	824,923	868,180	834,470
Managers-----	36,351	23,527	20,894	21,060
Tenants-----	2,361,271	1,444,129	1,149,239	735,849
	Percent	Percent	Percent	Percent
Full owners-----	50.6	57.4	57.4	57.1
Part owners-----	10.1	15.3	18.2	22.5
Managers-----	.6	.4	.4	.6
Tenants-----	38.7	26.8	24.0	19.8
LAND IN FARMS				
Full owners-----	36.0	36.2	34.2	30.8
Part owners-----	28.3	36.5	40.7	44.8
Managers-----	6.3	9.1	8.6	9.8
Tenants-----	29.4	18.3	16.4	14.5

1/ Sample data for 50 States.

Because of rounding, the percentages shown may not total 100.0 U.S. Bureau of the Census, Census of Agriculture.

From 1954 to 1959, the total number of farms declined from 4.8 to 3.7 million, a drop of 23 percent. A little more than a fifth of the decline can be accounted for by a change in the definition of a farm whereby 323,000 units, most of them under 10 acres in size, were no longer counted as farms. Only farms of 500 acres and over showed an increase. The addition of each farm of 500 acres and over from 1954 to 1959 was accompanied by a disappearance of 77 smaller farms.

There has been a gradual increase in the proportion of all farmland in larger farms, particularly those of 1,000 acres or larger. The percentage of all farmland in those farms increased from about a third to a half during the period 1940 to 1959. The number of farms and amount of land in farms of 260 to 499 acres in size was relatively stable over the period 1940 to 1959. Farms below 260 acres in size have decreased sharply in numbers and in amount of land operated.



The trend toward fewer and larger farms is seen also in the increase of farms with \$10,000 or more in farm products sales. From 1954 to 1959, the number of these farms increased from 12 to 22 percent of all farms (table 12). In 1959, 13 percent of all farms had sales of \$10,000 to \$20,000, and 9 percent had \$20,000 or more. There was a 72-percent decline in farms with less than \$2,500 in sales. Price levels were roughly comparable in the two periods.

Noncommercial farms, including part-time, residential, and abnormal farms have also declined in numbers, although they increased between 1954 and 1959 from 30 to 35 percent of all farms. The land area of these farms amounted to 127.6 million acres in 1954, 11 percent of the total. The total land area of noncommercial farms in 1959 was 146.1 million acres, 13 percent of the total land in farms.

Capital investment needed for farming, as measured by the constant dollar value of productive assets per farm, more than doubled between 1940 and 1964. In current dollars, the average investment per farm in 1964 was three times that of 1950, and nine times the average investment per farm in 1940. Thus, larger and larger amounts of resources must be amassed by persons wishing to start or stay in farming.

The increase in capital requirements is partly reflected by changes in the tenure pattern, particularly the increase in part owners. Over half of all rented land is operated by part owners who, on the average, have achieved a larger scale of operation than either full tenants or full owners. In 1959, part owner farms averaged 604 acres, compared to 164 acres for full owners and 222 acres for tenants.

There are, in addition to changes in the distribution of major tenure groups, important developments in tenure arrangements that are not revealed by historical tenure data.

Contract farming and other forms of vertical coordination have received greater attention in recent years, particularly for such enterprises as broiler production, where a high degree of specialization is feasible. These contracts are a useful means of obtaining additional capital and assistance in management and marketing. Although some farmers who use such arrangements may gain, there is concern as to the effects on management control of farms from the use of these arrangements.

Another arrangement being used more extensively is incorporation. There are at present about 15,000 corporations engaged primarily in farming. Incorporation of farms was encouraged by recent revisions in the Internal Revenue Code that permit certain small, closely-held corporations to elect to be taxed as partnerships. Earnings of those corporations that meet the necessary requirements are taxed only as income of the individual shareholders and not as income of the corporation. Other well-known advantages of corporate organization are limited liability, perpetual life, and improved financing opportunities. But these advantages, as well as the tax-saving opportunity, may be slight for most small and medium-sized farms.

Table 12.--Number of farms and percentage of all farm products sold, by value of farm products sold, United States, 1950, 1954, and 1959 <sup>1/</sup>

Value of farm products sold	1950			1954			1959		
	:			:			:		
	Farms	Percentage: : of all : farm sales:	Thous.	Farms	Percentage: : of all : farm sales:	Thous.	Farms	Percentage: : of all : farm sales:	Thous.
Commercial farms:									
\$40,000 or more-----	--	--	--	--	--	102	2.8	31.5	
\$25,000 or more-----	103	1.9	134	2.8	31.3	--	--	--	
\$20,000-\$39,999-----	--	--	--	--	--	210	5.7	18.5	
\$10,000-\$24,999-----	381	7.1	449	9.4	26.9	--	--	--	
\$10,000-\$19,999-----	--	--	--	--	--	483	13.0	21.9	
\$5,000-\$9,999-----	721	13.4	707	14.8	20.5	654	17.6	15.4	
\$2,500-\$4,999-----	882	16.4	812	17.0	12.1	618	16.6	7.4	
Less than \$2,500-----	1,619	30.1	1,226	25.6	7.1	349	9.4	1.5	
Commercial farms----	3,706	68.9	3,328	69.6	97.9	2,416	65.1	96.2	
\$10,000 or more-----	484	9.0	583	12.2	58.2	795	21.5	71.9	
Less than \$10,000-----	3,222	59.9	2,745	57.4	39.7	1,621	43.6	24.3	
Other farms <sup>2/</sup> -----	1,672	31.1	1,455	30.4	2.1	1,292	34.9	3.8	
All farms-----	5,379	100.0	4,783	100.0	100.0	3,708	100.0	100.0	

<sup>1/</sup> All data based on reports for a sample of farms. Percentages computed from unrounded data.  
<sup>2/</sup> Includes part-time, part-retirement, and abnormal farms. Definition of the first two of these classes and of commercial farms with less than \$2,500 farm sales differed in 1959 from previous years.



The Internal Revenue Service estimates that about 127,000 farms are taxed as partnerships. In view of the capital required to achieve desired income levels, there are good reasons for farm operators to seek ways of acquiring additional resources and thereby obtain the efficiencies of larger size. Even so, the unlimited liability feature and other disadvantages of most legal partnerships may tend to discourage their wider use. Some lease arrangements, notably livestock-share leases, are often similar in operation to a partnership but without its legal features. There is also a substantial amount of leasing among relatives, amounting to about a third of all leases of both part owners as well as full tenants. It is to be expected that some of the kinship-leasing arrangements closely resemble partnerships in that they involve joint participation in decision-making as well as providing farm resources.

Because of competition for rental land, farmers who might otherwise have sought to rent land may buy it. In the post-war period, an increasing proportion of land transfers have been credit-financed. In 1963, cash payment for farm real estate occurred only a third as frequently as in 1946. Of several means of financing land purchases, conventional mortgage financing is the most common. However, the use of land contracts to finance land transfers has increased substantially in recent years. Nationwide, about 30 percent of all landownership transfers are now financed by land contracts, about 3 times as many as in 1946. Their use is greatest in seller-financed transfers. In 1963, 38 percent of all farmland transfers were financed by the seller. Over two-thirds of these transfers are by land contracts.

### Rangeland

As indicated earlier, grazing is the largest single use of agricultural acreage. The 878 million acres of pasture and range comprise the largest portion of the Nation's grazing resources (table 13). There is an additional 66 million acres of cropland which is used only for pasture. Almost three-fourths of the area grazed is in non-Federal ownership.

Nearly all the private and other non-Federal grassland pasture and range, or 474 million acres, is in farms and ranches. The remainder is mainly in grazing districts. About 93 million acres, or 60 percent, of the 161 million acres of private and other non-Federal woodland and forest pasture, is in farms and ranches.

Over 92 percent of the 243 million acres of Federal range is used by permit, and, as such, is not included in tabulations of land in farms and ranches. The remaining 8 percent, consisting chiefly of scattered areas, is used under lease. Part of the leased acreage is reported in farm and ranch holdings.

Table 13.--Pasture and range, 1959 1/

(Million acres)		:
Ownership by classes of pasture and range	: 48	: 50
	: States	: States
Private and other non-Federal land: <u>2/</u>	:	:
Permanent grassland pasture and range <u>3/</u> ----	: 473	: 474
Woodland and forest pasture <u>4/</u> -----	: 160	: 161
Total private and other non-Federal land-	: 633	: 635
Federal range <u>5/</u> -----	: 240	: 243
Total-----	: 873	: 878

1/ Preliminary tabulations for the 48 contiguous States from Conservation Needs Inventory and land use inventory projects.

2/ Private, Indian, State, and local government land, or non-Federal land.

3/ From Conservation Needs Inventory 1957-59. (Excludes about 9 million acres of wild hayland harvested for hay, included in cropland harvested acreage.)

4/ Special estimates of non-Federal woodland and forest land pastured made by Conservation Needs Inventory technical workers.

5/ Federal range open and usable for grazing; compiled from records and reports of principle Federal land management agencies.

### Forest Land

About seven-tenths of the Nation's commercial forest land and two-tenths of the noncommercial forest land is privately owned. The percentage is somewhat higher in the 48 contiguous States (table 14). About 90 percent of private commercial forest land is in the East, while 60 percent of the public land is in the West.

The Forest Service manages nearly 100 million acres of commercial forest land--20 percent of the total and two-thirds of the amount that is publicly owned.

Forest industries control 13 percent of the commercial acreage and some 60 percent is held by several million other private owners, three out of four of which are farmers. As a group, farmers control one-third; and about one-fifth of all farm acreage is forested. The average tract is under 50 acres in size, making practical management a difficult proposition.



Table 14.--United States forest land area, 1963

Ownership	Commercial	Noncommercial	Total			
	Million acres	Percent	Million acres	Percent	Million acres	Percent
48 Contiguous States:						
Federal-----	107.6	21	71.0	52	178.6	28
Other public-----	28.0	6	8.2	6	36.2	6
Private-----	366.4	73	57.2	42	423.6	66
Total-----	502.0	100	136.4	100	638.4	100
50 States:						
Federal-----	113.2	22	<u>1</u> /183.8	74	297.0	39
Other public-----	28.7	6	8.5	3	37.2	5
Private-----	367.0	72	57.7	23	424.7	56
Total-----	508.9	100	<u>2</u> /250.0	100	758.9	100

1/ Includes 112.7 million acres in Alaska, ownership breakdown not available, primarily Federal ownership until State selection completed.

2/ Part of this area in Interior Alaska will meet standards for commercial forest land but detailed data are not yet available.

As a general rule, timber values are the main reason for owning timber tracts, but in many localities from one-third to over two-thirds of the area of small holdings is held primarily for grazing or with the intention of clearing for agriculture. In others, considerable areas are held for residential and recreational use, the satisfaction of owning land, and for other purposes not directly related to production of income.

Nonresident ownership appears to be widespread and people not living on their forest property may own two-thirds to nearly three-fourths of the forest area in some localities.

About one-half of the area in nonindustry ownerships changes hands so frequently that benefits of management are not readily apparent to owners. Nearly one-fifth of the area changes hands every 5 years and over one-half changes ownership every 15 years. Although frequency of change is not clearly associated with intensity of management, the changes in policy and treatment that accompany ownership changes may contribute to the generally low management performance on small forest holdings.

Aside from the public forest land system, certain functional aids have evolved historically in the United States to assist primarily in development and use of private forest land resources. They are research, education, credit, and forest management assistance. Each has had an impact on the forest land resource. All are significant devices for strengthening forest land tenure and production of forest land resources.

Research and credit have largely assumed the form of direct Federal action in the field. Education and forest management assistance have developed around a pattern of cooperative Federal-State relations. Cost sharing with owners and cost sharing with the States have evolved as useful methods. Direct government assistance to landholders has grown over some 40 years from tree planting aid to a whole array of additional forest land assistance programs.

The Clark-McNary Law of 1924 materially extended the cooperation of the Federal Government with the States. This Act spurred widespread efforts in forest-fire prevention and suppression, the distribution of tree-planting stock, and farm-forestry extension activities.

Woodland improvement practices, the establishment of plantation and shelterbelts, forest-treatment measures for small watersheds, and disease and insect control measures have been added. Although cost-sharing formulas have varied, the institution of public aid to increase the effectiveness of our established land tenure system has become a central feature of public policy.

#### Water Rights and Regulations

Federal, State, and local levels of government exercise control over water resources. Authority may stem from constitutional provisions, statutory legislation, or judicial decisions.

Federal authority is limited to powers expressly granted or reasonably implied by the Constitution. Within the sphere of delegated power, the Federal authority is paramount. All remaining powers are reserved to the States or to the people.

#### Federal Activities and Authorities

Activities of the Federal Government are generally concerned with flood control, navigation, irrigation, hydroelectric power, water supply, watershed protection, fish and wildlife preservation, recreation, pollution abatement, sediment and salinity control, drainage, and others, including various combinations in multiple-purpose water projects and programs. Regulatory and review functions include licensing non-Federal development of power, licensing structures in navigable waters, deciding controversies and apportioning water between States, and the approving of interstate compacts.

Sources of enabling authority for Federal activities provided by the Constitution include the commerce power, the proprietary power, the treaty-making power, the war power, the general welfare power, the interstate compact approval power, and equitable apportionment under powers to decide interstate controversies.



Commerce and proprietary powers are perhaps the most important Federal authorities. The commerce power provides for Federal jurisdiction over all navigable waters of the United States, including related non-navigable reaches and tributaries. This power may be used to authorize projects in flood control, navigation, watershed development, hydro-electric power, and multiple-purpose river basin development.

Under the proprietary power, Congress has broad authority to control the use of Federal public lands. It provided the legal foundation for the Reclamation Act of 1902. This source of authority has additional significance for electric power, since energy generated by falling water at a Federal dam becomes exclusive Federal property that may be sold or leased.

Under the treaty-making power, the Federal Government has jurisdiction over international relations concerning the division and development of waters in international streams. Water developments may be modified to serve national defense purposes.

Federal powers to apportion waters in an equitable manner and interstate compact approval powers will probably be used more in the future. As demands on existing water resources increase, there will be more requests by States for reapportionment of water supplies and for new compact arrangements to manage and develop water resources.

#### State Water Law

Insofar as consistent with Federal authority, each State may adopt its own system of water law. State laws establish conditions for the development, management, and use of water by individuals, firms, and local government bodies. They largely govern the acquisition and transfer of water rights.

For the most part, non-Federal public and private agencies operate under State laws. The structure and application of such laws, accordingly, are important. Perhaps the most significant type of State water legislation is that dealing with the private water rights of individuals.

The doctrines that govern such rights generally are based on land-ownership or prior appropriation. The riparian doctrine accords rights to the use of water to certain land on the basis of the land's contiguity to the supply. The owner of a tract of land on a watercourse has certain rights in the flow of the stream.

In several States the owner may divert any water he needs for domestic use, but for irrigation and other purposes the use must be reasonable with respect to the requirements of others.

The same principle applies to the ownership of land that overlies an underground stream. Some States permit limited use of the water on nonriparian land provided that the riparian owners are not adversely affected. In a few States rather extensive nonriparian use may be permissible. The riparian doctrine usually applies to both navigable and nonnavigable watercourses, but may be subject to uses for navigation, fishing, or other public purposes.

Under the appropriation doctrine, the earliest right to water from a particular watercourse has priority over all later rights regardless of the location of the land with respect to the stream. This priority means that in times of water shortage earlier rights have precedence over later rights.

Appropriation rights attach to specified quantities of water and often to specific times, places, and methods of diversion. The right is kept in good standing through use. It may be lost through nonuse over a period in most States.

Doctrines applied to percolating ground water include the English rule permitting virtually unlimited use and the American rule of reasonable use, with its modification in the form of the doctrine of correlative rights. Application of the appropriation doctrine to percolating ground water is similar to that for watercourses. Water rights are acquired by those who first withdraw the water and put it to beneficial use.

The riparian doctrine is generally applied to watercourses in most of the 31 Eastern States. Permit requirements are superimposed in some cases upon the basic riparian system.

The riparian doctrine is recognized to varying degrees in the six Western States crossed by the 100th Meridian, and the three States that border the Pacific, and Alaska. In Hawaii, the riparian doctrine exists along with several other types of rights.

The appropriation doctrine is exclusively followed in eight Western States. It is a part of the law in Alaska and in nine other Western States, and elements of the doctrine exist in some Eastern States.

For percolating water the English rule is still followed in some States, both Eastern and Western. It has been replaced in many by either the American rule of reasonable use or by that of correlative rights.

The riparian and appropriation doctrines are in effect concurrently in many States. In certain States both may apply to watercourses; in others the appropriation doctrine may apply to watercourses but not to percolating waters.

In the United States, the riparian doctrine of water rights is composed primarily of judicial law, although there are some statutes that affirm the existence of or modify such rights. In the West some constitutional or statutory provisions may sever riparian rights or limit their operation.



The appropriation doctrine, in its operation and extent, is covered by constitutional provisions and statutes, supplemented by hundreds of high court decisions. However, it evolved basically from custom, which in the absence of legislation was recognized by the early courts.

The early statutes essentially codified prevailing customs and regulations. The more elaborate statutes were enacted to cover complications.

State law in appropriation doctrine States usually gives domestic and municipal use the highest preference. Irrigation is frequently second, and commercial and industrial use is third. The influence of these preferences is limited in many States to the initial granting of appropriations, with an exception sometimes made in periods of extreme drought when water may be rationed according to a special system of preference.

Each basic doctrine has certain advantages and limitations. In general, riparian principles are not well suited for comprehensive river basin development and appropriation principles would appear to have somewhat greater possibilities. However, it is necessary to examine the particular circumstances and conditions of a region in order to determine which principles are best suited for regional development. There are numerous arrangements and conditions that may alter the operation of both the riparian and appropriation doctrines. These include voluntary contractual arrangements, the exercise of eminent domain, prescriptive rights, and dedication to public use.

As water rights expand, there will be increasing need for modifying existing systems of water rights to facilitate resource development and management to provide sufficient flexibility to respond to changing needs.

### Land and Water Resource Districts

Special natural resource districts are important institutions managing and directing use and development of land and water resources.

Special districts, which include various land and water resource districts, are units of government created through processes specified by State-enabling statutes. The functions of districts are narrower in scope than are the functions of civil governments. Districts most often have a single function but occasionally have several. However, even multifunction districts have fewer functions than civil governments. Districts have legally, functionally, and spatially defined areas of jurisdiction. Geographic boundaries are superimposed on the pattern of civil governments.

To be considered a unit of government distinct from authorities, boards, committees and commissions, districts must have the following governmental characteristics: existence as an organized entity, governmental character, and substantial autonomy. There is not always a clear differentiation between districts, authorities, or commissions. Many units called districts, upon close examination, are discovered to be a subgroup

of established civil governments. On the other hand, authorities which are considered adjuncts of established civil governments occasionally are found to be independent units and are included in the data for special districts by the Census of Governments.

In 1962, there were about 8,500 land and water resource districts in the United States. The total number of special districts was 18,323. Thus, about 46 percent of all special districts were natural resource districts. The number of both special districts and land and water resource districts has more than doubled since 1942 (table 15).

Thirty percent of all special districts were located in the 212 Standard Metropolitan Statistical Areas in 1962. The number of special districts in SMSA's increased 45 percent during the 1957 to 1962 period. This does not include districts in the hundreds of smaller urban areas that also are experiencing impacts of urban expansion.

Table 15.--Number of special and natural resource districts, United States, 1942-1962

Type of district	1962	1957	1952	1942
Total number special districts <sup>1</sup> /----	18,323	14,423	12,319	8,299
Total number natural resource districts-----	8,458	7,323	4,740	3,627
Drainage-----	2,240	2,132	2,174	1,955
Soil conservation-----	2,461	2,300	571	<sup>2</sup> /
Irrigation and water conservation:	781	564	641	523
Flood control-----	500	209	206	200
Parks and recreation-----	488	316	194	128
Water supply-----	1,502	787	665	357
Other natural resources-----	176	353	222	386
Multifunction natural resources--	310	662	67	78
Natural resource districts as percent: of total special districts-----	46.2	50.8	38.5	43.7

<sup>1</sup>/ In addition to natural resource districts, the following categories are included: Fire protection, highways, housing, cemeteries, health, hospitals, libraries, sanitation, other utilities, and other single function districts.

<sup>2</sup>/ Not classified as independent special districts in 1942.

Compiled from 1942-1962, Census of Governments. Bureau of the Census.



Special districts have several advantages over established units of government such as counties for developing natural resources. District boundaries can be stretched or trimmed to fit a problem area and need not conform to county, township or city boundaries. This flexibility allows some direct, basic correlation between those who pay the costs and receive the direct benefits.

Districts are not affected by tax and debt limitations imposed on governments by State constitutions or statutes unless States also place such limitations specifically on the districts. Districts can be empowered to incur debt and levy taxes outside the normal government limitations and thus invest in natural resource development when other governmental units may be unable to do so.

District operating and decision-making functions are located at the grassroots level encouraging greater citizen participation and understanding of the district's affairs. Decision-making also is simplified when activities are not a part of complex governmental administrations.

Districts also have some drawbacks. Districts are said to be inefficient and costly. They tend to duplicate investments in facilities, organizational and administrative structures, thus raising questions on economies of size. Special districts pyramid the debt and tax loads on taxable property. Financing costs are often increased for both districts and surrounding municipalities, as a result of the total debt load of each being expanded independently.

The multiplicity of governments created by having many special districts superimposed on the normal governmental structure may contribute to voter apathy or confusion and can result in something less than desired citizen participation and control of decision-making.

Special districts may not be accountable to their State for money collected and spent, thus losing the fiscal advantages to the districts and the taxpaying public from systematized review.

Enabling statutes may not include explicit procedures for dissolution, merger or annexation which are necessary procedures for districts that have fulfilled their function or desire to join with other districts for economy reasons.

#### Projected Resource Requirements

Land and water resource planning and policy decisions should rest on the best available information and prevailing outlook with respect to trends in population growth, economic activity, technology and yields, imports and exports, and the requirements of all the various uses competing for land and water resources.

The most important single factor determining the demand for the products and services of land and water resources is population growth. Requirements are also affected by changes in consumer income and other forces modifying the level and composition of diets, population shifts and age distributions, farm product price levels and relationships, the development of both new uses and of synthetic substitutes for farm products, and levels of exports and imports.

Increases in crop yields resulting from improved technology is the most important single factor affecting the supply of agricultural products. Output is also influenced by innovations affecting production efficiency, the quantity and quality of resources utilized and rates of resource development and improvement, costs of input factors in relation to output prices, weather, and control of plant and animal pests.

Changes in technology affect the production, marketing and utilization of agricultural products and thus may influence both resource requirements and resource productivity. Technological change in recent decades has operated in the general direction of increasing supplies and reducing requirements. The rate at which nonagricultural substitutes have been developed has exceeded the development of new uses for agricultural products.

Nonagricultural uses of land and water will continue to expand with economic growth and population increases. Both increased total requirements and the composition and location of changes in nonagricultural requirements will be significant. While the total needs for these purposes are relatively limited, their impact on certain areas and types of land and water resource requirements may be significant.

In addition to foreseeable needs, public programs must also take account of uncertainties and make adequate allowance for unpredictable contingencies. This includes provision for maintaining the productive capacity of the resource base, permitting sufficient flexibility in resource uses to meet changing needs and, to the extent feasible, the avoidance of potentially detrimental irreversible decisions.

#### Assumptions and Economic Framework

The calculated land and water requirements are based on a number of assumptions and economic projections. Estimates of projected crop and livestock requirements are based primarily on a statistical analysis of demand and supply relationships for the post-war years, supplemented by empirical evidence from other studies. Crop yields, water uses, and other factors affecting estimated resource requirements in 1980 are based largely on projections of levels and trends during the last decade or two.

The projections used should be regarded as reflecting likely directions of change rather than as precise expectations. Variations within the plausible range of particular projects such as population, crop yields and exports would significantly affect the calculated resource requirements. Furthermore, achieving the yield and efficiency levels assumed will require continuing stress on the development and application of improved farm practices.



## Population and Income

Population and economic growth in the United States and abroad will directly affect the demand for food and fiber production over the next 15 years. The total population for the 50 States is projected at 245 million for 1980, an increase of over 35 percent above 1960. This represents an annual increase of about 1.5 percent per year.

Even greater increases are expected in both gross national product and per capita disposable income (table 16). Gross national product would be about double that of 1960, implying an annual economic growth rate of about 4 percent. Disposable income per capita would be up around 50 percent from 1960. This represents growth in terms of dollars of constant purchasing power and, thus, represents real gains in the output of goods and services.

Table 16.--Population, economic growth and consumer income per person in selected years, and projections for 1980

Year	Population <u>1/</u>	Gross national product <u>2/</u>	Disposable income per capita <u>2/</u>
	Million	Billion dollars	Dollars
1960-----	180.7	521	1,993
1963-----	189.4	585	2,125
1980-----	245.3	1,080	3,050

1/ Population of the U.S. as of July 1, including Alaska and Hawaii, as well as Armed Forces abroad. Projections are the second highest or series B estimates (Projections of the Population of the U.S. by Age and Sex to 1985, Current Population Reports, Series P-25, N. 279, February 1964). The four projected levels (A, B, C, and D) vary with the fertility assumption; the B series assumed a small decline in the completed fertility and most nearly approximates current population growth.

2/ Estimates in 1963 prices.

The assumption of an approximate balance in the demand-supply situation for farm products by 1980 would indicate the likelihood of some adjustments in agricultural price levels and relationships. With continued advances in production technology and yields, combined average prices for all farm products still may average close to the 1961-63 average. Under projected demand-supply relationships for 1980, crop prices may average somewhat lower than the 1961-63 average; and livestock prices somewhat higher.

## Projected Utilization of Farm Products

Under the assumed economic framework, the domestic use of farm products is expected to rise at least as rapidly as population growth over the next 15 years. Little change from prevailing levels is expected in per capita food consumption. While rising incomes shift the pattern of food consumption toward more preferred foods, the pounds of food consumed per person have changed little and tend to decline over time. The demand for farm products in nonfood uses is more responsive to price and income changes. Under projected prices for cotton and other major nonfood commodities, per capita nonfood uses may continue a slight downward drift.

Divergent trends have occurred in the post-war years in the demand for various types of livestock products. A substantial increase has occurred in the per capita consumption of beef; and poultry consumption per person has also been rising. The consumer preference for pork has been weak; the long-run downward trend in per capita use of butter has continued; and, in recent years, there have been persistent declines in other high fat milk products and in eggs. Food uses account for the bulk of the livestock products, with nonfood uses mostly byproducts. Considering livestock products as a whole, gains in per capita utilization are likely to be rather modest even at comparatively favorable prices to consumers.

Food uses of crops account for around two-fifths of the crop output. Although food uses per capita have been relatively steady, pronounced changes are occurring in the consumption of various types of crops. Substantial declines in fresh uses of fruits and vegetables are being offset by increases in frozen, canned and other processed foods. Per capita use of fats and oils has been rather stable, while consumption of cereals continues to decline, although less rapidly than in the past two decades.

Another two-fifths of the crop utilization is for feed. The demand for feed depends on the kinds and amounts of livestock products produced, relative prices of feed and technological developments affecting feeding efficiency. Despite potentials for improvements in feed conversion for most types of livestock, favorable product-feed price relationships and abundant feed supplies during the past decade have led to a continued increase in the rate of feeding. The demand for feed is expected to continue as a major source of expansion in the demand for crops during the next 10 to 20 years.

Crop exports are expected to continue to represent upward of one-fifth of the total crop output. The dollar value of total exports of crops and livestock products projected for 1980 is around one-third larger than in 1963.



## Farm Output Requirements

Farm output is the volume of farm production available for domestic use and exports. An increase in farm output of about 45 percent from 1959 would be needed to match projected requirements for 1980. Compared with 1959, projected requirements for crop production would be up almost 50 percent; for pasture, up over 40 percent; and for the net contribution of livestock to total farm output, up almost 40 percent (table 17).

The required increases in output above 1963 would be substantially lower. Due to a combination of record levels of both crop and livestock production, farm output in 1963 reached a new high of 12 percent above the 1957-59 average. Compared with 1963, requirements for 1980 would be up about one-third for total farm output; somewhat under two-fifths for crop output; and less than one-third for both pasture and added livestock products.

The estimates reflect a continued upward trend in the rate of feeding per livestock production unit. From 1950-52 to 1960-63, the amount of feed fed to cattle and calves per 100 pounds of liveweight production increased about 9 percent, and feed fed to hogs rose about 13 percent. The rate of feeding for broilers and laying flocks decreased substantially. Although annual fluctuations occurred over the period in feed per unit of milk production, there was no significant trend. With the assumption of more favorable product-feed price relationships, the feeding rate per production unit by 1980 would be expected to be around 10 percent above 1963, with the total amount of concentrates fed up almost 50 percent.

## Crop and Pasture Yields

Projected crop yields for 1980 reflect a continuation of upward trend rates since 1950. Among the more significant factors contributing to higher yields are the use of more fertilizer, higher yielding varieties, improved production practices and greater timeliness of operations made possible by advances in mechanization. Increased use of commercial fertilizers has affected farm production more than any other single factor. The use of fertilizer nutrients per acre harvested in the United States has increased from 13 pounds in 1950 to 37 pounds in 1964. Both the acreage fertilized and rates of application have increased. The productivity of fertilizers has been further increased by such improved practices as better placement and tillage, improved seed, and better rates and timing of seeding. Many farmers are finding that if they invest in fertilizer, they cannot afford to neglect associated practices.

Crop yields have also increased significantly as a result of increased use of commercially grown seeds of hybrid varieties or improved strains. The shift to hybrid corn and sorghum resulted in dramatic increases in yields. High-yielding varieties of numerous other crops are under continuous development.

Table 17.---Farm output in selected years, and projected requirements for 1980

Item	(1957-59 dollars)										Increase	
	1949	1954	1959	1960	1961	1962	1963	1980	Pct.	Pct.		
	Mil. dol.	Mil. dol.	Mil. dol.	Mil. dol.	Mil. dol.	Mil. dol.	Mil. dol.	Mil. dol.				
Farm output <u>1</u> /----	25,223.4	27,069.1	30,054.7	30,882.2	31,132.7	31,288.6	32,524.6	43,670	45	34		
Total crop pro- duction-----	17,370.4	17,479.0	19,569.5	20,440.8	20,238.8	20,279.5	21,169.3	28,970	48	37		
Pasture pro- duction <u>2</u> /-----	1,523.9	1,771.9	1,767.3	1,779.2	1,833.7	1,856.9	1,918.0	2,480	41	29		
Product added by livestock-----	7,484.2	8,485.0	9,173.8	9,100.6	9,486.8	9,576.8	9,870.1	12,720	39	29		

1/ Estimates of crop production, pasture production, and product added exceed the value of farm output by the amount of farm-produced power (horses and mules) and the production of seed for hay and pasture.

2/ Based on rough approximations of value of feed-equivalent units, including forage obtained from aftermath grazing.



Improved production practices such as continuous corn and skip-row cotton production, increased use of pesticides and herbicides, selection of soils of higher productivity and generally improved managerial ability have all operated to increased yields.

Mechanization has increased yields through improving the timeliness and quality of farming operations. Farm planting can be done on time, and harvesting can be speeded up with fewer field losses and improved quality.

All of these developments have operated to reduce the effects of weather on yields, perhaps permanently.

There is no evidence that there will be an abatement in the future rate of technological advance. Numerous studies have shown that output could be greatly expanded through the application of currently known improved practices.

The projected value of crop production per harvested acre for 1980 is 61 percent above 1959, and 92 percent above 1954. The projected yields reflect expectations of increases of 50 percent or more over 1959 for such crops as corn, grain sorghum, oats, wheat, peanuts, tobacco, cotton and hay.

The value of crop production for 1963 is estimated at \$72.25 per acres, an increase of about 20 percent from 1959. Maintaining such a level would represent the achievement of about one-third of the total anticipated increase between 1959 and 1980. In order to attain the 1980 goals, a further increase of only about one-third above the 1963 value would be required. As with output, crop production per acre reached a new peak in 1963. New yield records were established for corn, oats, peanuts, rice, cotton, tobacco and many other less important crops.

The projected value of pasture production in 1980 is 36 percent above 1959 and 45 percent above 1954 (table 18). An increase in the quality of land used for pasture as the result of shifts from cropland to pasture should contribute to increased productivity per acre of pasture. Nevertheless, attaining the projected yield levels will require continuing emphasis on production research and continuing programs to encourage the adoption of improved practices by farmers.

#### Requirements for Cropland

The projected requirements for crop production in 1980 (table 17) and projected values of crop production per harvested acre (table 18) provide the basis for estimating the required acreage of harvested crops in 1980. This acreage requirement is projected at 299 million acres, a decline of 26 million acres from the acreage harvested in 1959 (table 19).

Table 18.--Crop production per harvested acre, 1954 and 1959,  
and projected requirements for 1980

Item	1954	1959	1980	Increase 1959-80
	<u>Dol.</u>	<u>Dol.</u>	<u>Dol.</u>	
Crop production per acre harvested <u>1</u> /				
Value (1957-59 dollars)-----	50.52	60.40	96.95	61
Index (1954 = 100)-----	100	120	192	--
Pasture production per acre <u>2</u> /				
Value (1957-59 dollars)-----	1.62	1.73	2.35	36
Index (1954 = 100)-----	100	107	145	--

1/ Based on projections of individual crops weighted by the 1963 acreage composition.

2/ Value per acre of all pasture and range. Projection derived by combining separate utilization estimates of cropland pasture, open permanent pasture, woodland pasture, and grazing lands not in farms.

Table 19.--Use of total cropland in 1954 and 1959, and projected  
requirements for 1980  
(Million acres)

Land use	1954	1959	1980	Change 1959-80
Acres of crops harvested-----	(346)	(325)	(299)	(-26)
Acres double cropped-----	(7)	(8)	(7)	(-1)
Cropland harvested-----	399	317	292 <i>312</i>	-25
Crop failure-----	12	11	10	-1
Cultivated summer fallow-----	29	31	29	-2
Total cropland used for crops--	380	359	331	-28
Soil improvement and idle cropland--	19	33	14	-19
Cropland used for pasture-----	66	66	72	+6
Total-----	465	458	417	-41



The total cropland used for crops, however, includes acreages of crop failure and cultivated summer fallow. The cropland needed for crop production is estimated at 331 million acres for 1980, a decline of 28 million from that used in 1959.

In addition to land planted to crops or in preparation for planting, total cropland includes land in soil improvement crops that are neither harvested nor pastured, idle cropland, and cropland used only for pasture. The total cropland requirement for 1980 is estimated at 417 million acres, a decline of 41 million acres from 1959. A projected increase of 6 million acres of cropland used only for pasture would supply a substantial portion of the required additional forage production from pasture. Progress since 1959 in achieving shifts in cropland uses and a comparison with 1980 projected requirements are shown in table 20.

The combined effects of the Conservation Reserve, Wheat and Feed Grains programs have been to bring the current acreages of cropland harvested and total cropland used for crops very nearly in balance with requirement levels projected for 1980. Implementation of the Feed Grains program in 1961 was principally responsible for reducing the acreage of cropland used for crops to within 8 million acres of the projected requirement. Diversions under the Wheat program in 1962 further reduced acreage toward the projected level for 1980. In 1963 slightly reduced diversions under both the Wheat and Feed Grains programs in combination with releases under the Conservation Reserve Program resulted in 336 million acres of land used for crops, or 5 million acres in excess of the projected 1980 requirement.

The amount of cropland not used for crops undoubtedly has increased substantially since 1959 as it is unlikely that the total cropland acreage has changed greatly. Most of this increased acreage consists of land withdrawn from production under the diversion programs. The acreage of cropland used only for pasture probably has remained relatively stable at about the 1959 level.

The projected total cropland requirement together with the estimate that about 18 million acres of new cropland will be developed suggests a shift of a total of 59 million acres of cropland to noncrop uses by 1980. Since, however, it is believed that nearly 6 million acres of cropland will be absorbed by urban expansion and related uses, the needed total shift to uses such as open pasture and range, forestland, and recreation and wildlife areas is about 53 million acres. If it is assumed that a part of the land shifting to rotation pasture and urban uses would also require assistance, the crop acreage likely to need some form of adjustment assistance would total around 55 million acres.

It should be emphasized that calculations of land requirements are based on a series of single estimates of future population, income, pattern of consumers' expenditures, exports, crop yields, and livestock feeding efficiencies. Departure from any of these projections would, of course, modify the estimates of future land requirements.

Table 20.--Comparison of current acreages used for crops with projected requirements for 1980

Type of cropland	(Million acres)						
	1960	1961	1962	1963	1980	Change	
						1960-80	1961-80; 1962-80; 1963-80
Crops harvested-----	(324)	(303)	(295)	(300)	(299)	(-25)	(-4) (+4) (-1)
Double cropped-----	(7)	(7)	(7)	(7)	(7)	(0)	(0) (0) (0)
Cropland harvested-----	317	296	288	293	292	-25	-4 +4 -1
Crop failure-----	7	12	11	12	10	+3	-2 -1 -2
Cultivated summer fallow 1/-----	31	31	31	31	29	-2	-2 -2 -2
Total cropland used for crops-----	355	339	330	336	331	-24	-8 +1 -5

1/1959 acreage, the most recent year for which data are available.



The population projection of 245 million for 1980 corresponds with the Census Bureau Projection (Series B) which approximates current population growth and assumes a small decline in completed fertility relative to the three-year period, 1960-63. Aggregate per-acre crop yields were projected to 1980 at a level 61 percent above that of 1959 and basically reflect an extrapolation of trends since 1950. The sensitivity of calculations of future land requirements to assumed levels of the several variables may be illustrated by computing cropland requirements associated with different population and yield projections.

A population projection 15 million higher than assumed for the calculations in this report would increase requirements for harvested crops by about 17 million acres. Similarly, a projected aggregate crop yield increase of 51 percent instead of the 61 percent assumed would increase needs for acreage in crops harvested by about 16 million acres. Future realization of both of these alternative population and aggregate crop yield levels would jointly result in a 1980 crops harvested requirement 30 to 35 million acres in excess of that calculated in this report. With crop yields for 1980 remaining at 1963 levels, harvested acreage requirements would be up from that projected by about 100 million acres.

#### Pasture and Range Requirements

The projected acreage needed for pasture and range was derived from the estimated value of pasture requirements (table 17), and the estimated value of pasture production per acre (table 18), with account taken of the forage value of crop residue and quality composition of the projected pasture and range acreage. It was believed that by 1980 increased productivity of present pasture and rangelands would account for about two-thirds of the projected 41 percent increased pasture production requirement and that nearly one-third of the additional requirement would have to be met from new pasture and range acreage.

An almost infinite number of possibilities exist for varying the combinations of the type of pasture and range that might be added to the present acreage. For example, based on projected yields, all of the additional production could be obtained from either increasing cropland pasture by 15 to 16 million acres or by expanding improved open permanent pasture and range by 30 to 35 million acres. In contrast, meeting the additional requirement entirely from unimproved open pasture and range would necessitate expansion of this type of grazing land by at least 100 million acres.

The estimates (table 21) assume that 35 to 40 percent of the needed additional production from pasture will be met by increasing the amount of cropland used only for pasture by 6 million acres, and the remainder will be met by shifting and improving land less suited to continuous crop production to pasture. The net increase in land used for pasture would total 27 million acres, 6 million of which would be classified as cropland pasture, 21 million of which would be classified as open permanent pasture and range, including 19 million acres improved and 2 million acres unimproved.

No significant change is expected to occur in the area of woodland and forest used for grazing.

Table 21.--Land in pasture and range in 1959, and projected requirements for 1980

(Million acres)			
Land use	1959	1980	Change 1959-80
Cropland used only for pasture-----	66	72	+6
Open permanent pasture and range-----	633	654	+21
Woodland and forest pasture and range-----	245	245	--
Total-----	944	971	+27

#### Forest Land Requirements

Activities designed to meet projected demands for timber by the end of the next half century must be initiated now. By the end of this century we will need to be growing about 81 billion board feet of sawtimber to meet projected demands for timber products. This is 67 percent more than is presently being grown. About three-fourths of this will need to be softwoods. About 38 percent of the total needed growth must come from the West, 45 percent from the South, and 17 percent from the North.

The supply outlook appears favorable until about 1990. Thereafter, a deficit of supply begins to show up with the gap widening by the year 2000 and beyond. The situation is more serious for softwood species of the kind used most for timber products.

Goals should be those to produce the amount and quality of timber that the American people will require. This means that public forests must aim to nearly double their present growth, forest industry to raise its growth 50 percent and farm and other private 25 percent by the year 2000. Growth on State and private forests combined must be increased one-third.

Forest lands are not making the resource contribution for which they are capable, but conversely much of the forest land is unproductive; contributing to poverty; contributing to siltation; and detracting from desirable scenic values and generally a drag on the Nation's economy.



The greatest new or expanded effort in achieving improved forest land management must be expended on behalf of the more than 300 million acres owned by private individuals. These lands are producing at only about half capacity, and much of the timber being grown is of poor quality. Most of the tracts are too small to be economically managed alone. They need to be handled in larger groups in order that the economics of size can be more readily realized.

Particular emphasis must be directed toward improving the projected softwood supply situation and reducing the downward trend in quality in line with probable needs at reasonable cost. Trees for lumber needs of 2030 must be planted today. Weed trees, and trees of poor form, rotten, or otherwise of poor quality must be removed to make room for preferred growing stock. Pruning and thinning must be done where needed to raise the quality of existing stands. Losses from fire and pests and from harvesting and manufacturing must be reduced and ways found to use material being wasted to make available supplies go farther.

Shifts to and from forest lands are expected to more or less compensate. However, in view of the timber demand situation and the fact that forest lands will continue to be sought for other uses, no surplus of commercial forest land is in prospect.

The area of commercial forest land available for timber production was estimated at 531 million acres in 1959 (table 22). An additional 6 million acres is expected to be made available by 1980. This net gain in commercial forest land is expected to result from a shift of 13 million acres of cropland and 9 million of pasture and range to commercial forests, compared with shifts of commercial forests to other uses of about 16 million acres.

Table 22.--Forest land acreage, 1959 and projected 1980

Land use	1959	1980	Change 1959-80
	Million acres		Percent
Forest land:			
Commercial-----	509	515	+6
Noncommercial-----	250	242	-8
Area limited primarily to recreation or wildlife use-----	(27)	(33)	(+6)
Total-----	759	757	-2

A net decline of 8 million acres of noncommercial forest land is expected as additional areas are reserved for recreation and wildlife purposes, urban areas expand, and lands are improved for grazing. Combination of the estimated increase in commercial forest land with the estimated decrease in noncommercial forest land results in an expected overall decline of about 2 million acres in the area classified as forest land.

### Nonagricultural Land Requirements

Nonagricultural uses of land may be grouped into two broad categories: special-purpose uses and miscellaneous other areas. Special-purpose uses include urban and built-up areas, recreation and wildlife areas, and areas used for public installations and facilities. Demands for land for special-purpose uses are closely tied to population growth, and the changing demands for facilities and services arising in a developing economy. The land use category, miscellaneous other areas, includes land which at any time has limited economic use, and consists of desert, bare rock, swamps, and other similar types of land.

The total acreage needed to meet requirements for special-purpose uses is projected to reach 190 million acres by 1980, an increase of 43 million acres over 1959 (table 23). A decline of 13 million acres is expected in the amount of land classified in miscellaneous other uses.

Table 23.--Nonagricultural land uses, 1959 and projected requirements for 1980

(Million acres)			
Land use	1959	1980	Change
Special-purpose uses-----	147	190	+43
Urban and built-up areas-----	54	73	+19
Recreation and wildlife areas-----	62	81	+19
Forest land-----	(27)	(33)	(+6)
Nonforest-----	(35)	(48)	(+13)
Public installation and facilities----	31	36	+5
Miscellaneous other areas-----	291	278	-13
Total-----	438	468	+30



Urban expansion, and other uses such as highways and airports are expected to absorb an additional 19 million acres of rural land by 1980. This estimate roughly reflects a continuation of the recent rate of absorption of about 1 million acres a year; however, it suggests a slightly decreased per capita requirement as urban people will seek to minimize long travel distances to the central city and employment, and thereby substitute convenience for residential space.

Recreation and wildlife areas include national, State and local parks, wildlife refuges, and areas designated as primarily for recreational use. These areas are expected to expand from 62 million acres in 1959 to 81 million acres by 1980. This 19 million-acre increase is expected to consist of 6 million acres of forested land and 13 million acres of nonforested land, including cropland, pasture and range, and unproductive lands classified as miscellaneous other land.

Areas devoted to national defense, water control reservoirs, public industrial purposes, and other related uses totaled 31 million acres in 1959. It is estimated that 36 million acres will be required for these uses in 1980.

Limited opportunity exists for the economic utilization of the 291 million acres classified in 1959 as miscellaneous other land. Over three-fourths of this acreage is in Alaska and, therefore, is remote from the large population centers that might generate nonagricultural demands for its use. For the Nation as a whole, the acreage of land classed as miscellaneous other land is expected to total 278 million acres in 1980.

#### Summary of Major Land-Use Patterns and Shifts, 1959-80

To balance use with expected requirements for land, three principal land-use adjustments appear necessary. Calculations in this report indicate prospective need for a net reduction of 41 million acres of cropland by 1980. In contrast, significant additional acreages are expected to be required for grassland pasture and range, and for special-purpose uses (table 24).

To obtain needed net adjustments, account must be taken of the gross shifts of land among uses that are likely to occur. For example, to meet the expected increase in requirements for grassland pasture and range, account must be taken of the urban development likely to absorb some land presently used for grazing. This necessitates a gross shift of land to grazing uses in excess of the additional 21 million acres estimated as needed to balance use with requirements. Similarly, new lands will be brought into crop production through resource improvement and development and to offset this increase in the cropland base a gross shift of cropland to other uses must exceed the expected needed net reduction of 41 million acres.

Table 24.--Shifts in major land uses, 1959-80

(Million acres)					
Land use	: 1959	: Reduc- : tions	: Addi- : tions	: Net : change	: 1980 pro- : jections
Cropland-----	: 458	59	18	-41	417
Grassland pasture and range----	: 633	29	50	+21	654
Forest land <u>1</u> /-----	: 732	30	22	-8	724
Farmsteads and farm roads-----	: 10	2	--	-2	8
Special-purpose uses-----	: 147	--	43	+43	190
Miscellaneous other land-----	: 291	13	--	-13	278
Total-----	: 2,271	133	133	--	2,271

1/ Commercial and noncommercial forest land, exclusive of 27 million acres of forest land limited primarily to recreation or wildlife use in 1959 and 33 million acres in 1980. Total forest land acreage was 773 million acres in 1959 and is projected at 771 million acres in 1980, an overall decrease of 2 million acres.

A composition of gross shifts of land among uses that would balance all uses with expected requirements is shown in table 25. This particular composition was based upon historical shifts, judgment as to the extension of these shifts into the future, and judgment regarding the reasonableness of alternative shifts that would balance uses and requirements.

In order to offset the addition of 18 million acres to cropland through land development and improvement, and cultivation of abandoned farmsteads and roads, it is estimated that 59 million acres of cropland needs to be shifted to other uses. About 6 million acres of this would be absorbed by preemptive nonagricultural uses, leaving about 53 million acres in possible need of program assistance in shifting use by 1980. Most of the cropland shift will be to pasture and range in response to the need for additional forage. Lesser amounts of cropland will shift to commercial forests and recreation and wildlife uses.

A shift of about 50 million acres to open pasture and range may be obtained by shifting 37 million acres of cropland, 12 million acres of forest land, and 1 million acres of abandoned farmsteads and roads to this use. About 29 million acres of pasture and range are expected to shift to other agricultural and nonagricultural uses, leaving a needed net increase of 21 million acres.



Table 25.--Composition of shifts in major land uses, 1959-80

(Million acres)									
Land use shift from--	Reduction	Shift to--						Forest land	
		Crop-land	Urban areas	Publicly owned	Publicly owned	Publicly owned	Publicly owned		
		land	and built-up areas	recreation or wildlife use	installations and facilities	and range	and range		
Cropland-----	59	--	5	3	1	37	13		
Pasture and grazing-----	29	10	5	4	1	--	9		
Forest land-----	30	7	4	6	1	12	--		
Commercial-----	(16)	(6)	(2)	(3)	(1)	(4)	(-)		
Noncommercial-----	(14)	(1)	(2)	(3)	(-)	(8)	(-)		
Farmsteads and farm roads:	2	1	-	-	-	1	--		
Miscellaneous other-----	13	--	5	6	2	--	--		
Total-----	133	18	19	19	5	50	22		

A shift of 13 million acres of cropland and 9 million acres of pasture and range to commercial forest land is counterbalanced by a shift of 16 million acres of commercial forest land to other uses, leaving a net increase in commercial forest land of 6 million acres. Noncommercial forest land is expected to decrease by 14 million acres as a result of shifts to other uses.

Additional land for special-purpose uses will come from all major use classes of land. The entire 13 million-acre reduction in miscellaneous other lands will result from these lands being shifted to nonagricultural uses.

### Projected Water Uses

Water-use trends were projected on the basis of data given in table 9, with results summarized in table 26.

Table 26.--Supplies and uses of water in the United States, 1/ 1960 and projections for 1980

Item	Supply or use				Increase 1960-80
	1960 <u>2</u> /		1980 <u>3</u> /		
	Million ac. ft.	Percent	Million acre ft.	Percent	Percent
Annual renewable supply----	1,326	--	1,326	--	--
Annual withdrawals:					
All withdrawal uses-----	287	100	674	100	133
Agricultural withdrawals--	107	37	133	19	24
Irrigation withdrawals---	103	36	128	19	24
Irrigated acres (millions)	33.70	--	43.25	--	28
Annual consumption:					
All consumptive uses-----	73	100	102	100	40
Agricultural consumption--	65	89	82	80	26
Irrigation consumption <u>4</u> /	62	85	78	76	26

1/ Excludes Alaska and Hawaii.

2/ Data for 1960 generally from Geol. Surv. Circ. 456 and various reports of the Bureau of the Census.

3/ Estimates for 1980 developed by the Economic Research Service.

4/ Consumptive use estimates for both 1960 and 1980 include consumptive use associated with conveyance in irrigation withdrawals and accordingly are slightly higher than those given in Geological Survey or other Department of Agriculture reports.



On the basis of trends since 1940, it is estimated that total water withdrawals by 1980 would be more than double those in 1960. Agricultural withdrawals would increase by about one-fourth, in contrast to a trebling in nonagricultural withdrawals. Total withdrawals in 1980 would be equivalent to about 50 percent of the surface and ground water supply, compared to about 20 percent in 1960.

The consumptive use of water is estimated to increase from 73 million acre feet in 1960 to 102 million in 1980, an increase of about 40 percent. About 85 percent of the 1980 withdrawals would be available for reuse, compared with less than 75 percent in 1960.

Agriculture would continue to be the predominant consumptive user of water in 1980. Irrigation and other agricultural uses of water would be expected to account for 80 percent of the total consumptive use, compared with 89 percent in 1960. The 26-percent increase in agricultural consumptive use would account for about three-fifths of the increase in total consumption. Consumptive use attributable to irrigation alone would fall from 85 percent in 1960 to 76 percent in 1980, despite a projected increase of about 9.5 million acres in irrigated land.

In evaluating the adequacy of the Nation's water supply for meeting anticipated uses in 1980, it should be recognized that present uses already approach or exceed the limit of available supplies in many of the major Western river basins. In many localities in the East, municipal and industrial demands have created supply and treatment problems. Water quality maintenance is of increasing concern throughout much of the country.

Because of the high rate of consumptive use in agriculture compared with other industries, the economic management of water in agriculture is closely related to balanced growth of all water-using industries and the entire economy. Modest gains in the efficiency of agricultural water use will result in substantial increases in supplies available for other uses. About one-fifth of the water withdrawn for irrigation purposes in 1960 was lost in transit through seepage and evapotranspiration from canal surfaces or vegetation. If conveyance losses could be reduced by 50 percent, irrigation could expand by over 4 million acres without any increase in irrigation water withdrawals.

Aside from such technologic advances as sea water conversion and possible weather modification, other opportunities exist for increasing renewable water supplies. Snow accumulation, sublimation, and melting rates can be controlled to some extent. More important are possibilities for increasing downstream water yields through the management of vegetation in upstream tributaries. Experimental evidence indicates, for example, that significant absolute increases in water yield from forested watersheds in high-elevation and high-rainfall areas can be obtained through improved vegetation management. Opportunities for such increases appear favorable on about 15 percent of the area of the Western States.

## Outdoor Recreation and Wildlife

### Outdoor Recreation

The resources that will be devoted to outdoor recreation in the next two decades are certain to become larger and the intensity of development greater. In the summer of 1960, 90 percent of all Americans participated in some form of outdoor recreation. This activity touched rural areas in every part of the country and totaled in all 4.4 billion separate outdoor recreation activity occasions. A doubling is projected by 1980 and a threefold increase by the turn of the century (table 27).

Table 27.--Estimated participation in outdoor recreation in 1960 and projections for 1980 and 2000

(Millions of occasions)	
Year	Number of occasions (all activities)
1960-----	4,377
1980-----	9,180
2000-----	12,449

Source: Estimates based on ORRRC Report, "Outdoor Recreation for America," 1962.

These increases may be surpassed on many public lands, particularly forest lands. Projected visits to the National Parks and Monuments indicate that recreation activity may increase five times by the century's end. On the National Forests and Grasslands, a sixfold increase is expected. And for the many State Parks of the Nation, a fourfold jump in visits is considered probable.

This expanding demand requires a concentrated attack on the development needs of outdoor recreation, particularly in the heavily populated regions of the country like the Northeast. Suitable locations are available for many outdoor activities in all sections of the country (table 28). Development and management for increased recreation use has often lagged. The expanding demand also calls for greater attention to multiple-use of land where recreation and other uses can be managed together to get the most advantageous use of the available acreage.



Table 28.--Nonurban public designated recreation areas in the 48 States, 1960

Area type	Land area	Number of areas
	Millions of acres	Number
Forest-----	185.2	1,177
Park-----	22.1	4,027
Fish and wildlife-----	18.2	4,912
Transportation-----	4.0	11,876
Water development-----	.9	82
Special authorities---	1.3	139
Other-----	2.3	1,835
Total-----	234.0	24,048

Source: Estimates based on ORRRC Report, "Outdoor Recreation for America," 1962.

Public acreage designed as available for nonurban outdoor recreation in the 48 States amounted to about 234 million acres in 1960. Sixty million acres of this, including some 14 million acres in the National Forest Wilderness, Wild and Primitive Area Systems and about 13 million acres in the National Parks, may be considered primarily for recreational use. The total number of public nonurban areas devoted to recreation is about 24,000. Potentials exist for nearly a tenfold increase in development site capacity for key facilities at present designated public areas.

In addition to the public lands, private lands supply an important part of outdoor recreation resources. The range in intensity of use varies widely. At one extreme of the scale might be placed summer homes and at the other extreme the vast tracts of commercial timberlands. The role of private land is certain to play a greater part in meeting future requirements. Their use will be particularly significant in areas where public recreation resources are limited.

Within State and regional areas of the Nation most of the recreation land is located where population is sparse (table 29). Either the location of the land or restrictive management policies, or both, greatly reduce its effectiveness for recreation use for the great mass of the U.S. population.

#### Fish and Wildlife

Within the last decade, there have been two nationwide surveys of hunting and sport fishing by the U.S. Fish and Wildlife Service--one in 1955 and another in 1960. Those surveys show that more than one-third of all households in the United States have one or more members who engage in hunting or fishing for sport.

Table 29.--Number, acreage, and related population of nonurban public designated recreation areas in U.S., 1960.

Section	Number	Area	Population
		<u>Millions of acres</u>	<u>Percent</u>
48 States			
North-----	13,538	38,352	54
South-----	5,554	26,495	31
West-----	4,956	169,153	15
Total-----	24,048	234,000	100
50 States			
Alaska & Hawaii-----	243	48,639	1/
Total-----	24,291	282,639	100

1/ Less than 1 percent.

Source: Estimates based on ORRRC Report, "Outdoor Recreation for America," 1962.

About 25 million persons participated in these sports in 1955. By 1960, that number had increased to about 30 million. This represents an average annual increase of 1 million, or a rate of approximately 4 percent a year. If that rate of increase continues during the next two decades, there will be 50 to 60 million hunters and fishermen by 1980, or twice the number we now have.

The public land and water area dedicated to fish and wildlife use in 1960 amounted to 29.2 million acres. Of this total, 7.8 million acres were in Alaska. Within the 48 contiguous States there were 21.4 million acres administered by fish and wildlife agencies. By level of government, this total was distributed as follows: Federal, 8.8 million acres; State, 12.5 million acres; and county and local, 0.1 million acres.

The impressive extent to which States have been acquiring land for wildlife conservation purposes is a reflection of expanding popular interest. There is every prospect that this activity will continue, and that the land dedicated especially to wildlife will expand substantially by 1980.

#### Multiple Resource Use

As the competition for use of land increases, so does the need for more intensive land use and the need for putting the land to more than one use. Today the competition has become keen enough that the American people can ill afford to use vast land areas for a single purpose if that purpose can also be served in combination with other uses of the same land.



Urban expansion, super highways, new airports, power lines, pipelines, dams and reservoirs, and national defense withdrawals are absorbing millions of acres of agricultural and forest land each decade. Some of this demand on land resources could be accommodated by multiple-purpose management of land.

The principle of multiple use is ~~not~~ restricted to forest lands, although it has found its widest application there. Crop production, quality forage for cattle, and habitat for wild game and birds occur together on many farms. Recreation, timber, wildlife habitat, water, forage and crops may be joint products of the same farms and ranches. Roadside zones can produce wildlife habitat, recreation sites, and water. Reservoir lands can produce recreation opportunity. Suburban and rural communities can develop the landscape to utilize wooded areas to the maximum for recreation and watershed protection as well as for residential development.

Encouragement of multiple use of private land needs to be continued and expanded in many similar ways because the need is effective use rather than total area. Water resource development, for example, is already generally accepted for multiple purposes and can be extended into new areas of the Nation where it is needed most. Rural recreation development and wildlife habitat improvement have large-scale needs yet unmet in many agricultural areas. And farm woodland management offers ample room for progress in providing the public with timber as well as watershed protection, wildlife, and income-producing recreation.

The public lands too have their requirements in multiple-purpose use and development. With the demand for water expanding rapidly in all parts of the country, public lands will become increasingly more valuable for the water which originates on them. The National Forests, for example, comprise only one-fifth of the public lands in the West today, but more than half of the water in the West originates on them. This will continue to be true because these lands are at the higher elevations where most of the precipitation occurs. Manipulation of the vegetative cover is required to increase water quantity and improve quality. Management of forests for water is tied closely to management of timber and forage production. Public Law 86-117 specifically directs this multiple use and sustained yield management of the National Forest System. The significance of multiple use in forest land is discussed in more detail in Appendix B.

Despite progress now being made in multiple use of our land resources, it is not likely that the trend to greater demands upon the Nation's land and water resources can be entirely met in the decades ahead by simply substituting multiple-use management for land. Adjustments in land use are going to continue as new demands pile up and as a dynamic economy changes the emphasis in present patterns of land use. Some changes may have to be hastened and others retarded to provide for an orderly accommodation of national requirements.

## APPENDIX A

### Definitions and Regional Distribution of Land Capability Classes

#### Class I Land

Soils in this class have few or no conditions that limit their use. Class I land is suited to a wide range of plants and may be used safely for cultivated crops without special conservation treatment and for pasture, range, woodland, and wildlife. The land is nearly level. The soils are deep, generally well drained, and easily worked. The soils hold water well and are either fairly well supplied with plant nutrients or highly responsive to fertilizer. They are productive and suited for intensive cropping. The land in class I is not subject to damaging overflow. The local climate is favorable for growing most of the common field crops.

About 36.2 million acres, or 2.5 percent, of the non-Federal rural land is in capability class I. The Corn Belt, Northern Plains, and Southern Plains regions contain slightly more than 52 percent of the total class I land.

Seventy-six percent of all class I land is now being used to produce cultivated crops. Eleven percent is being used for pasture and range, 10 percent for forest and woodland, and only 3 percent for other uses.

#### Class II Land

Soils in this class have some natural condition that limits the plants they can produce or that calls for some easily applied conservation practice when cultivated. Although the soils in class II require more careful management than class I to prevent deterioration or to improve air and water relations when the soils are cultivated, the limitations are few and the necessary conservation practices are easy to apply. Land in the class may be used for cultivated crops, pasture, range, woodland, wildlife food and cover, or outdoor recreation. The farm operator, however, has less latitude in the choice of crops and management practices than with class I. About 20 percent of the non-Federal rural land, or 290.5 million acres is in class II. Nearly two-thirds of the area of class II soils is now being used as cropland. About equal amounts, 15 percent of the total in each case, are being used for pasture and range and for forest and woodland.

The Corn Belt region has the highest percentage of class II land, with the Mountain and Pacific regions having the lowest. More than 80 percent of the class II soils in the Corn Belt and Northern Plains regions is cultivated, compared to less than 50 percent in the Southeast and Delta regions.



### Class III Land

The soils in this land class have more serious or more numerous limitations than those in class II. Such limitations may be natural, such as steep slope, sandy or shallow soil, or too little or too much water. Or the limitations may be the result of erosion brought about by past misuse. The land is more restricted in the crops that can be produced and when cultivated require conservation practices more difficult to install and maintain.

Appropriately managed, the land in this class may be used for cultivated crops, pasture, woodland, range, wildlife cover and feed, and recreation. Limitations may restrict the amount of row crop cultivation; rotation practices; the timing of planting, tillage and harvesting; cropping patterns and yields; or combinations of these influences. About 311.3 million acres, or 21.5 percent of the land, is in class III. About half of the class III land is now being used to produce cultivated crops. Twenty-one percent is used for pasture and range; 25 percent for forest and woodland; and the remainder for other purposes.

The percentage of class III soils is high in the Delta, Northern Plains, and Southeast regions. More than 60 percent of the class III soils is used for crop production in the Corn Belt, Northern Plains, and Pacific regions, compared to less than 35 percent in the Southeast, Delta, and Appalachian regions.

### Class IV Land

Soils in this land class have very severe limitations that restrict the plants they can grow or the number of years they will produce a cultivated crop. When cultivated, they require very careful management and conservation practices are more difficult to apply and maintain than on soils in classes II and III. In subhumid and semiarid areas, special treatments and practices to prevent soil blowing, conserve moisture, and maintain soil productivity are required. In humid areas, they are suitable for occasional but not regular cultivation; in subhumid and semiarid areas, crops fail in low-rainfall years.

Some of the poorly drained, nearly level soils in class IV are not subject to erosion but are poorly suited to some crops because of wetness, frequency of overflow, or because of low productivity for cultivated crops. Some soils in class IV are well suited to one or more of the special crops, such as fruits and ornamental trees and shrubs.

About 169.2 million acres, or 11.7 percent, of the non-Federal rural land is class IV and is suitable for only occasional or limited cultivation. This class of marginally arable soils is about equally divided between the major land uses. About a third is used for pasture and range, a third for forest and woodland, and slightly less than a third, or 29 percent, for cultivated crops.

The proportion of class IV land is high in the Southeast, the Lake States, and Appalachian regions. The Southern Plains, Northern Plains, and Mountain regions also have substantial amounts of this class of land. The percentage of class IV land being cultivated is highest in the Corn Belt and Northern Plains regions where about 45 percent is in cropland. In contrast, in the Southeast region only about 9 percent of this class of land is being cultivated, and in the Delta region only about 16 percent.

#### Class V Land

Soils in this land class have little or no erosion hazard, but have some other condition impractical to remove. This limits their use largely to pasture, range, woodland, recreation, water supply, watershed protection, or wildlife feed and cover. Such limitations restrict the kind of plants that can be grown and prevent normal tillage of cultivated crops. Although nearly level, some are wet, are frequently overflowed by streams, are stony, have climatic limitations, or have some combination of these limitations.

About 43 million acres, or 3 percent, of the non-Federal rural land is in class V. Two-thirds of all the class V soils is now being used for forest and woodland, and one-fourth for pasture and range. Only 4 percent is used for cropland, and the remainder, also 4 percent, for other uses. Class V soils are concentrated especially in the Southeast and Delta regions.

#### Class VI Land

The soils in this land class have severe limitations that make them generally unsuited for cultivation and restrict their use largely to pasture, range, woodland, recreation, water supply, or wildlife food and cover. The soils in class VI are such that it is practical to apply range or pasture improvements, if needed, such as seeding, liming, fertilizing, or water control by means of contour furrows, drainage ditches, diversions, or water spreaders. Depending upon soil features and local climate, the soils may be well or poorly suited to woodland.

Some soils in Class VI can be used safely for the common crops if given unusually intensive management. Some of the soils in this class are also adapted to long-term meadows and sodded orchards that do not require cultivation and to special crops, such as blueberries, requiring soil conditions unlike those demanded by the common crops.

About 277.7 million acres, or 19.1 percent, of the non-Federal, rural land is in class VI. Three-fifths of this acreage is being used for pasture and range; 32 percent for forest and woodland; 6 percent for cropland; and 2 percent for other uses. The proportion of class VI land is large in the Mountain, Pacific, Northeast, and the Plains regions.

Of the 18 million acres of class VI land that is being cultivated, about 70 percent, or 12.4 million acres, is in the Northern Plains, Mountain, and Corn Belt regions. Most of class VI land in these regions, however, is used for pasture and range. This class of land is used mainly for forest and woodland in the Northeast, Southeast, Lake States, Appalachian, Delta States, and Pacific regions.



### Class VII Land

Because of one or more continuing limitations that cannot be corrected soils in this class have very severe restrictions that make them unsuited for cultivation. Even with careful management their use is restricted to pasture, range, woodland, recreation, water supply, or wildlife food and cover. The soil restrictions are more severe than those in class VI. These conditions make soils unsuited for common cultivated crops, although some soils may be used for special crops under unusual management practices. Physical conditions of soils in class VII make it impractical to apply such pasture or range improvements as seeding, liming, or fertilizing; or such water control measures as contour furrows, ditches, diversions, or water spreaders. Soils in this class may be well or poorly suited to woodland.

About 296.2 million acres, or 20.4 percent, of non-Federal rural land is in class VII. Slightly less than half of the class VII land, or 144.2 million acres, is now being used for forest and woodland and slightly less than that amount for pasture and range. Only 2 percent is in cropland, and slightly more is in other uses. Class VII land is especially prevalent in the Mountain, Pacific, Appalachian, Northeast and Plains regions.

### Class VIII Land

The soils and land forms in this class have limitations that prevent their use for commercial plant production and that restrict their use to recreation, water supply, or wildlife food and cover with careful protection. Land in class VIII cannot be expected to return significant onsite benefits from management for crops, grasses, or trees, although benefits from wildlife use, watershed protection, or recreation may be possible. Badlands, rock outcrop, sandy beaches, river wash, mine tailings, and other nearly barren lands are included in this class. With major works of reclamation, limited areas of class VIII land may be so altered as to make them suited to cropland use.

Slightly less than 2 percent of the non-Federal rural land, or 27.2 million acres, is in class VIII. About two-thirds of the land is being used within its capability; that is, for uses other than cropland, pasture and range, or forest and woodland. About 24 percent is in forest and woodland, and 9 percent in pasture and range. A very small acreage is in cropland.

The largest acreages of Class VIII land are in the Pacific, Mountain, and Delta regions.

## APPENDIX B

### Multiple Use of Forest Lands

Under multiple-use management, forest land resources can be utilized in harmony that will better meet the overall needs in the years ahead. Forest lands should be managed under a multiple-use system that provides for the following uses as well as timber.

#### Water

Forest lands include many of the most important watersheds in the Nation. What happens to forest land therefore has a direct bearing upon the amount and character of the water supply. Misuse of the forests is cause for much of the ruination of our streams and rivers through siltation, acid drainage from strip-mining, and other forms of pollution from onsite activities. Proper management of forest land on the other hand is insurance against these liabilities through maintaining watersheds in optimum condition to avoid excess runoff, to increase total yield wherever that is practical, and most important of all to maintain and improve water quality.

#### Recreation

One of the most pressing forest land resource demands is outdoor recreation. Overall, outdoor recreation is expected to increase some 3 to 4 times by the end of the century. National Forests, National Parks, and State Forests have experienced a phenomenal growth in outdoor recreation in recent years, and it is expected that demand on these lands may grow as much as 6 or 7 times over the next 40 years. The comparable rate of increase on private forest land is estimated to be about 3 times present levels.

The Nation's forest, water, and diverse topography combine in endless variety and virtually all outdoor recreation activities are firmly rooted in some combination of these resources. Much recreation is water oriented. Boating, water skiing, skin diving, swimming, and fishing are among the fastest growing outdoor sports. Forests are prime attractions to outdoor recreationists. They are customarily associated with rugged topography, scenic beauty, lakes, streams, and other natural features.

The most significant aspect to the current outdoor recreation situation is the need to catch up with the demand for recreation facilities and to move ahead in preparing for still greater demands. Another related problem is the need to harmonize conflicts between recreational users themselves and to a lesser degree between recreation and other uses of forest land.

There will have to be strenuous efforts made if the growth in recreation demand is to be met. Recreation land will have to be acquired by several levels of government, principally near heavy concentrations of people. Private owners of potential recreation land will have to be encouraged to develop their holdings for recreation along with other uses.



## Fish and Wildlife

It is expected that the need for wild game and fish will more than double over the next two decades. This is indicated by statistics on hunting and sport fishing, which show that about 25 million persons participated in these sports in 1955 and 30 million in 1960. If this rate of increase continues there will be 50 to 60 million hunters and fishermen by 1980.

Forest land is home to most of the big game in this country and a source for much of the fishing and of the better fishing streams. Game population, especially big game may create special management problems when their number increases beyond the normal carrying capacity of their habitat. Other problems include mounting threats to fish population from stream and river pollution and widespread destruction of fish habitat resulting from urban and highway development.

The private lands of the Nation, because of their extent and variety, hold the major potential for meeting the wildlife conservation and production needs of the future. Private lands provide roughly 85 percent of the wildlife habitat economically feasible of improvement and 80 percent of the game taken by hunting.

Growing pressure upon wildlife population and their habitat require sound management. Problems are numerous and many will be difficult to solve. All in all, wildlife population represents one of the many renewable natural resources currently under increasing pressures and clearly destined to receive even greater pressure as time goes on. Use and management of this resource like the others must be improved and strengthened if the needs of future generations are to be adequately met.

## Forage

Approximately 160 million acres of privately owned forest and woodland are grazed to some degree each year. Pine forests in the South, open coniferous forests in the West, and woodland in the Southwest are of primary importance for seasonal livestock use. While grazing occurs on hardwood forests studies indicate that livestock use in most cases is not compatible with hardwood timber production.

Demand for livestock production indicates a need for 22 percent more pasture and rangeland by 1980. No material net change is expected to occur in the area of woodland and forest used for grazing.

Forest lands suitable for livestock grazing must be made available for use under conditions that promote stability for communities and individuals and full development with due regard to other resources and uses.

### PART III. REGIONAL TRENDS AND SHIFTS IN RESOURCE USE

Current and prospective use of the Nation's land and water resources is characterized by wide regional variations. These variations are due primarily to two interrelated factors, the amount and quality of resources available in different regions of the country and the distribution of population. Future patterns of resource use can be significantly influenced, however, by public policies and programs. Information on trends in regional resource use provides a starting point for appraising the likelihood and desirability of future adjustments.

#### Cropland and Pastureland

The capability of resource base is the most important determinant of the use of land for crops and pasture. For most agricultural production, climate and suitability of the land for profitable use of modern technology is more important than distance to market centers. This is reflected in the use distribution of privately owned cropland by land capability classes in 10 farm production regions (table 30). Of some 448 million acres of cropland in 1958, 373 million were in land classes considered suitable for permanent cultivation. More than two-thirds of this productive acreage was located in 4 regions, the Corn Belt, the Northern and Southern Plains and the Lake States. This concentration of productive wealth is centered in the gently rolling interior prairies and plains, where precipitation is adequate for crop production. Some 65 percent of the total cropland acreage in 1959 was located in these 4 regions (table 31). Other highly productive cropland areas are widely distributed, such as the irrigated valleys of the West, and sections of the Delta and Atlantic Coastal Plain.

Of the gross decline of 24 million acres in total cropland from 1949 to 1959, only about 2 million acres came from the Corn Belt, the Northern and Southern Plains and the Lake States (table 32). By contrast, a 22 million-acre decline took place in the Northeast and in the three southern regions, Appalachian, Southeast, and the Delta States. While the regions where the bulk of the good cropland is located also have a considerable acreage of poorer class lands, widespread existence of better land has operated to limit the magnitude of the net reversion of cropland.

The more than 3 million-acre increase in cropland in the Mountain States was probably due in part to a trend of more dependence on feed grains and cropland pasture to replace poorer rangelands and to relieve overgrazing. The near half million acres of new irrigated land added in this region from 1949 to 1959 has also contributed to the cropland expansion. Though a small part of the national total, the gain in cropland in Alaska and Hawaii was significant for these States, and has been continuous for most of the past 50 years.



Table 30.--Privately owned cropland by land capability classes by farm production regions, Alaska and Hawaii, 1958

Farm production regions and States	Class I - III	Class IV	Class V - VIII	Total
	1,000 acres	1,000 acres	1,000 acres	1,000 acres
	Percent	Percent	Percent	Percent
48 States				
Northeast-----	16,963	2,730	1,214	20,907
Lake States-----	38,494	4,847	1,547	44,888
Corn Belt-----	84,191	6,329	4,207	94,727
Northern Plains--	79,195	8,021	6,680	93,896
Appalachian-----	21,652	3,536	2,174	27,362
Southeast-----	17,848	1,952	584	20,384
Delta States-----	18,820	1,203	694	20,717
Southern Plains--	48,141	5,557	2,554	56,252
Mountain-----	27,673	9,836	4,980	42,489
Pacific-----	20,132	4,898	746	25,776
Total-----	373,110	48,910	25,378	447,398
50 States				
Alaska-----	20	2	1	23
Hawaii-----	198	81	36	315
U.S. total-----	373,328	48,993	25,415	447,736

\* Less than 0.5 percent.

Table 31.--Cropland and pasture by farm production regions,  
Alaska and Hawaii, 1959

Farm production regions and States	Cropland used for				Open permanent pasture and range
	Crops	Soil improvement and idle	Pasture only	All purposes	
48 States	1,000 <u>acres</u>	1,000 <u>acres</u>	1,000 <u>acres</u>	1,000 <u>acres</u>	1,000 <u>acres</u>
Northeast-----	15,189	2,567	3,217	20,973	7,999
Lake States-----	36,668	4,170	4,657	45,495	8,266
Corn Belt-----	78,814	3,454	12,822	95,090	21,806
Northern Plains---	90,199	6,160	4,695	101,054	79,743
Appalachian-----	17,431	3,061	9,498	29,990	12,984
Southeast-----	14,566	2,208	4,297	21,071	13,939
Delta States-----	13,070	1,806	5,932	20,808	9,358
Southern Plains---	37,651	5,479	10,786	53,916	109,239
Mountain-----	34,404	3,710	4,838	42,952	312,832
Pacific-----	20,464	971	4,699	26,134	53,965
Total-----	358,456	33,586	65,441	457,483	630,131
50 States					
Alaska-----	16	4	4	24	2,350
Hawaii-----	320	13	167	500	646
U.S. total----	358,792	33,603	65,612	458,007	633,127



Table 32.--Changes from 1949 to 1959 in cropland and pasture by farm production regions, Alaska and Hawaii

Farm production regions and States	Cropland used for				Open permanent pasture and range
	Crops	Soil improvement and idle	Pasture only	All purposes	
	1,000 acres	1,000 acres	1,000 acres	1,000 acres	1,000 acres
48 States					
Northeast-----	-2,045	-539	-1,000	-3,584	1,071
Lake States-----	-1,575	1,733	-1,073	-915	2,115
Corn Belt-----	792	459	-2,117	-866	5,243
Northern Plains----	-3,721	4,086	23	388	2,688
Appalachian-----	-4,851	-815	-1,707	-7,373	3,869
Southeast-----	-5,589	-1,253	-6	-6,848	7,163
Delta States-----	-3,524	-3	52	-3,475	3,341
Southern Plains----	-7,025	5,129	1,826	-70	15,177
Mountain-----	-330	2,981	626	3,277	-35,029
Pacific-----	-293	-81	-515	-889	-6,585
Total-----	<u>1/-28,161</u>	11,697	-3,891	-20,355	-947
50 States					
Alaska-----	NA	NA	NA	12	-16
Hawaii-----	NA	NA	NA	35	-150
U.S. total-----	-28,161	<u>1/ 11,697</u>	<u>1/ -3,891</u>	-20,308	-1,113

1/ Excluding Alaska and Hawaii.

The picture is somewhat different for cropland actually used for crops. Here the overall decline is less concentrated in the three Southern regions and the Northeast, with a considerable decrease occurring in the cash grain areas of the Plains States. Declines in cropland used for crops are influenced more by farm programs. Such programs are not confined to poorer lands but have also effected reductions in some of the more productive lands used for crops (table 33). In the more productive regions, reductions in cropland

Table 33.--Cropland used for crops 1962 and changes from 1959 to 1962, by farm production regions

Farm production regions	Cropland used for crops	
	Total in 1962	Change 1959 to 1962
	<u>Million acres</u>	<u>Million acres</u>
48 States		
Northeast-----	14.4	-0.8
Lake States-----	33.3	-3.4
Corn Belt-----	72.0	-6.8
Northern Plains-----	82.7	-7.4
Appalachian-----	15.3	-2.1
Southeast-----	12.3	-2.3
Delta States-----	12.9	-.2
Southern Plains-----	33.9	-3.8
Mountain-----	33.7	-.7
Pacific-----	19.2	-1.3
Total-----	329.7	-28.8

used for crops have been accompanied by an increase in cropland used for soil improvement and left idle. Land in this category, except for the Mountain Region, tended to go out of farming.

Projections of national requirements for 1980 are 417 million acres of total cropland, and 331 million acres of cropland used for crops. The total acreage of cropland used for crops in 1962 was 330 million, about the amount of the projected level. Over the longer run, the production of specific crops tends to center in production areas where they can be produced at the most favorable unit costs. Crop production would, accordingly, be expected to move into those regions of inherently fertile lands with a high capacity to absorb capital inputs and to regions susceptible to resource development. Such increases would be at the expense of regions with less productive soils or other obstacles to the application of technology.



In the absence of such external forces as Government programs, crop production would tend to shift to such regions as the Corn Belt, the Great Plains and certain areas in the Mountain and Pacific regions. Increases in crop production would be relatively limited in regions of less responsive soils and small fields such as the Northeast, Appalachian, and Southeast.

The nature of Government programs could either facilitate or impede these trends. Such trends would be curbed by programs designed to withdraw highly productive lands from crop production. A program of this type would operate to keep lands out of crop production in such areas as the Corn Belt and the Great Plains. Long-term trends would be facilitated by programs fashioned to shift the least productive lands out of crop production. The latter type program would thus operate to accelerate the decline in cropland in the Northeast, Southeast, and Appalachian regions.

Open permanent pasture and range is projected to increase to 654 million acres in 1980, a 21-million-acre increase over 1959. Changes that occur in cropland are likely to have a material influence on future patterns.

Although open permanent pasture increased from 1949 to 1959 in 8 of the 10 regions, there was little change in the national total. In the regions that increased, the gains were due in part to reversion of cropland to permanent pasture, and to a greater extent to an appreciable land area cleared for pasture. This appears to be true particularly in the Corn Belt, the Northern and Southern Plains, the Lake States and to some extent in the Southeast.

Substantial declines in permanent pasture occurred in the Mountain and Pacific regions and Hawaii. Although these declines are partly due to a reclassification of low-productivity brushlands, they also reflect a withdrawal from grazing of some of the poorer rangelands.

Although the lessened dependence on rangelands is likely to continue in the Mountain and Pacific regions, reductions in total acreage may be small. The expansion in the national total acreage in open permanent pasture is likely to result from continuing increases in the Eastern, Corn Belt, and Plains States.

#### Forest Uses and Timber Production

There has been an upward trend in forest acreage for several decades due to shifts of open farmland to forests. The total forest acreage reached a level estimated at 759 million in 1962. Of this, some 27 million were reserved for recreation and wildlife, while substantial acreages of non-commercial forest land were grazed.

The large shifts of cropland and pasture to forest have probably passed their peak. Only minor net changes in forest acreage are projected for 1980. Slight increases in commercial forest areas are projected in the North and South, where small declines are expected in the noncommercial forest areas. Essentially no change is expected in the commercial areas of the West, where a small increase is expected in the noncommercial areas.

The pattern of forest ownership is also likely to remain fairly stable, with 80 to 90 percent of the commercial forest area in the East in private ownership, and some two-thirds of the commercial forest area in the West and Coastal Alaska in public ownership. The bulk of both the commercial and noncommercial forest area in interior Alaska and Hawaii is in public ownership.

Significant differences exist in the productivity of different types of private holdings. Forest industry lands are relatively high in productivity of recently cut areas compared with other private ownerships. In contrast, the productivity of farm and other nonindustrial private holdings is generally low across the Nation. More than half of the 21,000 forest industry holdings are in the South, with most of the remainder in the North. The past 25 years have been a period of heavy industrial development in the South, particularly among pulp and paper industries. The South also holds a high proportion of farm ownerships contributing to industrial wood utilization.

Today sawtimber stands predominate in the West and Coastal Alaska. A greater proportion of the Eastern commercial forest lands are in younger growth, with understocking of sawtimber stands more prevalent in the East than in the West. Live sawtimber volume was estimated at approximately 2 billion board feet for 1962, with a total growing stock at about 0.5 billion cubic feet. The West and Coastal Alaska, with 25 percent of the commercial forest area, contained 70 percent of the live sawtimber volume but only 56 percent of the total growing stock (table 34). Clearly the eastern part of the country is strategic in maintaining future timber supplies. This is also evident from the estimates for 1962 timber cut for all products (table 35). The West accounted for about 41 percent of live sawtimber cut, and 35 percent of cut from total growing stock. More than half of the timber cut from all growing stock, and 45 percent of the total live timber cut came from the South.

To meet the Nation's demand for timber during the next two decades requires an appreciable increase in the annual rate of timber growth. However, growth rates in 1962 were significantly higher than a decade earlier and with continued improvement of forest management practices, particularly in the eastern regions, growth rates by 1980 should equal the required level.



Table 34.--Distribution of commercial forest area and timber volume by regions, 1962

Region	Commercial forest area	Growing stock volume	Live sawtimber volume
		- <u>Percent.</u> -	
North-----	36	22	13
South-----	39	22	17
West and Coastal Alaska--	25	56	70
All sections 1/-----	100	100	100

1/ Excluding 41.3 million acres of commercial forest in Interior Alaska and Hawaii.

Table 35.--Timber cut for all products by regions, 1962

Region	Growing stock			Live sawtimber		
	Total	Softwood	Hardwood	Total	Softwood	Hardwood
			- Million cubic feet -			
North-----	1,940	700	1,240	1,326	513	813
South-----	5,053	3,046	2,007	4,040	2,365	1,676
West-----	3,751	3,728	23	3,689	3,671	18
Coastal Alaska---	12	12	--	12	12	--
Total- <u>1</u> /----	10,756	7,486	3,270	9,067	6,561	2,507

1/ Excluding timber volume on 41.3 million acres of commercial forest area in Interior Alaska and Hawaii.

## Water Management and Use

Both uses and supplies of water differ markedly in the 22 water resource regions of the U.S. mainland, and in Alaska and Hawaii. In terms of water withdrawn, agricultural uses of water are minor in the eastern regions, but make up the bulk of withdrawals in the West where over 90 percent of the Nation's irrigated lands are located (table 36). In this respect, Alaska resembles the characteristics of the East while Hawaii is more similar to the West. Despite the more rapid growth of industrial and municipal uses over farm uses, agriculture is expected to continue to account for a substantial proportion of the total use in 1980.

Table 36.--Estimated withdrawals and consumption of water by water resource regions, Alaska and Hawaii, 1960

Water resource regions	Withdrawals			Consumption		
	All	Agri-	Irri-	All	Agri-	Irri-
	uses	cultural	gation	uses	cultural	gation
	uses	uses	uses	uses	uses	uses
	1,000	1,000	1,000	1,000	1,000	1,000
	ac. ft.	ac. ft.	ac. ft.	ac. ft.	ac. ft.	ac. ft.
New England-----	7,325	75	15	345	60	10
Delaware-Hudson-----	22,915	275	75	1,005	130	70
Chesapeake Bay-----	8,125	200	40	385	140	40
Southeast-----	21,210	1,020	520	1,550	970	490
Eastern Great Lakes---	14,880	210	20	490	115	15
Western Great Lakes---	18,310	260	20	595	120	20
Ohio-----	27,455	405	15	955	305	15
Cumberland-----	255	5	2	14	4	2
Tennessee-----	8,320	120	15	463	113	13
Upper Mississippi-----	12,557	557	30	628	418	30
Lower Mississippi-----	5,893	968	863	1,385	785	685
Lower Missouri-----	1,780	155	10	175	130	10
Lower Arkansas-----	5,475	850	725	910	610	500
Eastern mainland----	154,500	5,100	2,350	8,900	3,900	1,900
Upper Missouri-----	19,330	16,490	16,150	9,520	9,225	8,910
Upper Arkansas-----	6,275	5,225	5,100	3,900	3,700	3,590
Western Gulf-----	18,280	10,640	10,500	7,745	6,730	6,590
Upper Rio Grande						
and Pecos-----	2,940	2,740	2,700	1,700	1,680	1,650
Colorado Basin-----	15,210	14,610	14,525	9,165	8,955	8,885
Great Basin-----	7,345	6,595	6,550	4,090	3,990	3,960
Pacific Northwest-----	27,470	24,520	24,375	11,760	11,470	11,380
Central Pacific-----	24,690	18,570	18,350	13,690	13,465	13,320
South Pacific-----	10,960	2,510	2,400	2,230	1,885	1,815
Western mainland----	132,500	101,900	100,650	63,800	61,100	60,100
Mainland 48 States----	287,000	107,000	103,000	72,700	65,000	62,000
Alaska-----	233	7	0.09	0.90	0.56	0.06
Hawaii-----	2,064	1,131	1,120	534	496	482
U.S. total 50 States--	289,302	108,138	104,120	73,235	65,497	62,482



The more significant comparison is in terms of consumptive use, which is the amount of water withdrawn that is not returned to the source and, hence, not available for reuse. Here agriculture dominates the water-use picture even more completely in the West and Hawaii, and also becomes more important in the East; particularly the Southeast, the Mississippi drainage and the Lower Missouri and Lower Arkansas. Those regions have most of the irrigated lands of the East. Agriculture would account for about 80 percent of the consumptive use of water in 1980, compared with about 90 percent at present.

The best available single measure of supply is the maximum sustainable flow (table 37). This measure was used in the studies prepared in 1960 for the Senate Select Committee on Water Resources and represents the theoretical maximum of each region's runoff that can be made available through storage regulation. From the proportion of water supply consumed, it is apparent that water consumption is not a regionwide problem in the East. However, regionwide averages of obscure problems on small headwater streams where the flow is limited, and water is desired for irrigation and other withdrawal uses as well as for fishing and recreational uses.

In contrast to the East, water consumption equals or exceeds the available long-term supply in the Upper Rio Grande and South Pacific region, and approaches the limit in the Colorado Basin. Thus, water shortages are centered in the Southwest which even today depends significantly on importation of water from other regions and the mining of accumulated ground water supplies. The imbalance between water supply and use can be gaged from the fact that nearly half of the total Western maximum sustainable flow originates in one region, the Pacific Northwest. Over the long pull, long distance water conveyance and possibly desalination and weather modification will be needed to substantially alleviate the water problems of the West. With the possible exception of the South Pacific region, it is doubtful that substantial relief can be achieved from additional sources by 1980. In the Southwest, the need is greatest for conservation of water resources and increased irrigation efficiencies. Possibilities also exist for increasing runoff by several million acre feet through vegetative management on watershed lands, including the control of heavy water-using plants of little economic value.

Over a considerable acreage of cropland, particularly in the Upper Missouri, Upper and Lower Mississippi, and the Lower Atlantic Coastal Plain regions, excess water rather than an inadequate supply is the dominant problem. Future drainage programs in these areas will need to be carefully balanced with the requirements of swamps and wetlands for the support of migratory water fowl.

To concentrate entirely on water quantities would miss the increasingly important problem of water quality in the Eastern regions. The quality of the 146-million acre feet withdrawn and returned to streams and estuaries is more significant than the 9-million acre feet actually used up. The return of withdrawn water accounts for less than 20 percent of the water supply of the East, but they influence the aesthetic aspects and recreational capacity of large stretches of rivers and many lakes and shorelines.

Table 37.--Regional pressure on water resources conterminous States,  
by water resource regions, 1960

Water resource regions	Maximum sustainable flow	Proportion of sustainable flow	
		Consumption	Consumption plus waste dilution
	1,000 ac. ft.	Percent	Percent
New England-----	72,470	<u>1</u> /	75
Delaware-Hudson-----	34,835	3	81
Chesapeake Bay-----	56,900	1	63
Southeast-----	232,300	1	13
Eastern Great Lakes-----	43,240	1	<u>2</u> / 100
Western Great Lakes-----	44,800	1	<u>2</u> / 100
Ohio-----	121,530	1	9
Cumberland-----	17,360	<u>1</u> /	14
Tennessee-----	47,720	1	30
Upper Mississippi-----	65,975	1	<u>2</u> / 100
Lower Mississippi-----	53,200	3	14
Lower Missouri-----	16,240	1	14
Lower Arkansas-----	78,745	1	22
Eastern mainland-----	885,315	1	53
Upper Missouri-----	30,130	32	<u>2</u> / 100
Upper Arkansas-----	10,500	37	<u>2</u> / 100
Western Gulf-----	45,250	17	75
Upper Rio Grande and Pecos---	1,065	<u>2</u> / 100	<u>2</u> / 100
Colorado-----	11,650	79	<u>2</u> / 100
Great Basin-----	10,415	39	<u>2</u> / 100
Pacific Northwest-----	152,670	8	11
Central Pacific-----	61,950	22	33
South Pacific-----	360	<u>2</u> / 100	<u>2</u> / 100
Western mainland-----	323,990	20	57
Mainland (48 States)-----	1,209,305	5	54

1/ Less than 0.5 percent.

2/ Equal to or in excess of 100 percent.

The currently available methods of water quality control are (1) treatment of waste flows prior to discharge, and (2) increasing the assimilative capacity of receiving waters through streamflow augmentation. The best available measure of total pressure on water resources is the proportion of the sustainable supply required for both consumption and water quality maintenance (table 8). Waste dilution requirements are based on the minimum quality level required to allow sport fish to survive. Although the dilution requirements were computed for water use and waste



treatment levels in 1954, they are considered the approximate of 1960 requirements. These flows could also meet the water needs for hydro-electric power generation, navigation and other in-channel uses of water. They would also tend to abate flood problems by reducing seasonal extremes of streamflow.

When water quality is taken into account, the water balance in the East changes materially. In the Northeastern, Great Lakes, and Upper Mississippi regions, water requirements for consumption, plus waste dilution approach or exceed the maximum available supplies. These estimates indicate that unless waste-treatment levels are raised over those estimated to exist, water quality could not be maintained even with maximum streamflow regulation. Water quality problems are not confined to the East. When waste-dilution requirements are added to those of consumption, the area where water uses press on supplies is expanded to encompass the Southwest and all Western regions except the Northwest and Central Pacific regions.

From 1960 to 1980, increases in consumptive uses of water are expected to be moderate. Two opposing trends in water required for quality maintenance will be operating. More complete waste treatment will tend to reduce water requirements for waste dilution, but increased population and industrial activities will increase the gross pollution loads. On balance, waste dilution requirements are expected to decline over those required for adequate water quality in 1960. Projections of the Senate Select Committee indicate that with adequate investment in waste-treatment facilities, water requirement in the East can be met in 1980. Water supplies will be inadequate in all Southwestern regions. For these regions, projected growth of economic activities will need to be adjusted to limited supplies even with full development of water resources. Projected water needs for the Upper Missouri region can be met only with limitations on the expansion of swamps and wetlands for support of wildlife.

In summary, with adequate management, water supplies are sufficient for most of the East provided a vigorous program of water-quality management is maintained. The long-term prospects of the West seem to lie in long-distance conveyance of water, conservation and economic allocation of existing supplies, improved technology for augmenting runoff, and saline water conversion.

#### Outdoor Recreation

In considering regional patterns of outdoor recreation, it is necessary to distinguish between land-intensive types such as swimming, boating, picnicking and camping; and land-extensive types such as primitive camping in wilderness areas, white water canoeing, mountain climbing and hunting. Availability of the first type usually depends more on facility development than land area, while the second generally requires extensive land areas and unique scenic attractions.

The part of the country with the largest proportion of nonurban public designated recreation areas and generally best-suited for extensive types of recreation is the least densely inhabited. Population is concentrated in the East, particularly the Northeast, while public recreation areas are mostly in the West and Alaska (tables 38 and 39). Future population growth will only moderately remedy this imbalance between area and population. However, the regional distribution of the number of public facilities is more nearly in line with population reflecting the greater proportion of large extensive-use type areas in the West and Alaska with more of the smaller intensive-use type areas in the East. Data on private recreation facilities compiled for the Outdoor Recreation Resources Review Commission indicate that most types of private recreation enterprises are distributed more according to population.

Data of the Outdoor Recreation Resources Review Commission do not indicate a regionwide lack of recreational facilities for any of the major sections of the country, since expansion capacity was found adequate for meeting projected future needs. A problem of critical dimension does exist, nevertheless, within each of the four regions. This lies in the distribution of recreational facilities within, rather than between regions. There is urgent need for both expansion of areas, and development of recreational facilities within or near large metropolitan areas.

Table 38.--Number and acreages of nonurban public designated recreation areas in 48 States by regions and related population 1960 and projected to 1980

Section	:	Nonurban public recreation	:	Population					
				:	1960	:	1980		
							:	projected	
:	:	:	:	1/					
<hr/>									
	:			1,000					
	:	<u>Number</u>	<u>Pct.</u>	<u>acres</u>	<u>Pct.</u>	<u>Mil.</u>	<u>Pct.</u>	<u>Mil.</u>	<u>Pct.</u>
Northeast-----	:	2,569	10.6	9,288	4.0	44.7	25.0	56.4	23.1
North Central-----	:	10,969	45.6	29,064	12.4	51.6	28.9	64.5	26.5
South-----	:	5,554	23.1	26,495	11.3	55.0	30.8	76.8	31.6
West-----	:	4,956	20.7	169,153	72.3	27.2	15.3	45.6	18.8
<hr/>									
Total 48 States--	:	24,048	100.0	234,000	100.0	178.5	100.0	243.3	100.0
	:								

1/ This population projection is slightly less than that used elsewhere in this report.



Table 39.--Number and acreages of nonurban public designated recreation areas, U.S. total and related population, 1960 and projected to 1980

Section	Nonurban public recreation areas		Population					
			1960			1980 projected <sup>1/</sup>		
	Number	Pct.	1,000 acres	Pct.	Mil.	Pct.	Mil.	Pct.
Total 48 States---	24,048	98.9	234,000	82.8	178.5	99.6	243.3	99.4
Alaska-----	90	0.4	47,140	16.7	0.2	0.1	0.4	0.2
Hawaii-----	153	0.7	1,499	0.5	0.6	0.3	0.9	0.4
U.S. total-----	24,291	100.0	282,639	100.0	179.3	100.0	244.6	100.0

<sup>1/</sup> This population projection is slightly less than that used elsewhere in this report.

With rising incomes and mobility, the large scenic areas of the more sparsely inhabited parts of the country will serve increasingly for extensive-type recreation. The management problem in these regions is one of balanced development between recreation and other uses made of the same lands; and between wilderness-type of recreation areas and more intensive development types. While the role of the Eastern portions of the country in meeting demands for extensive-type of recreation are necessarily limited, there is a need to balance preservation of scenic areas and shorelines with other uses of these lands.

In all parts of the country a balance is also needed between private and public recreation enterprises. An effective contribution towards meeting outdoor recreation may be made by the judicious use of private concessions on public lands and the development of compatible private facilities adjoining public designated recreation areas. Increasing use is being made of the recreational potentials of farmland, particularly in the East and South. In those portions of the country the maintenance of hunting and fishing and other recreation opportunities on private farm and forest lands can serve as a major source of supply and make up for limited public lands available for these purposes. In all parts of the country a well-kept countryside contributes to enjoyment of the outdoors.

#### Nonagricultural Land Uses

In contrast to recreational areas, urban and built-up areas are more nearly related to the distribution of population, although the correspondence is not precise. This is seen more clearly by comparing the distribution of the urban population to that of urban and built-up areas (table 40). Urban population is concentrated on a smaller built-up area in the Northeast than in the rest of the country, and is least concentrated in the North Central

and Southern regions. For recreation and wildlife uses of land, the pattern area distribution in relation to population resembles that of nonurban public designated recreation areas discussed earlier. Public installations and facilities are predominantly in the West and the South, due in part to the greater prevalence of water control and defense facilities in those regions. The location of miscellaneous land area such as deserts, swamps, and other land of limited economic potential are largely the result of natural forces.

Table 40.--Estimated distribution of major classes of nonagricultural land by regions, 1959 and urban population, 1960

Section	Nonagricultural land					Urban population
	Urban and built-up	Recreation and wildlife	Public installations and facilities	Miscellaneous		
	Pct.	Pct.	Pct.	Pct.		Pct.
48 States						
Northeast-----	15	7	2	2		29
North Central-----	35	9	9	3		28
South-----	31	10	20	4		26
West-----	19	50	62	13		17
Total-----	100	76	93	22		100
50 States						
Alaska-----	<u>1</u> /	24	7	78		<u>1</u> /
Hawaii-----	<u>1</u> /	<u>1</u> /	<u>1</u> /	<u>1</u> /		<u>1</u> /
U.S. total-----	? 100	100	100	100		100

1/ Less than 0.5 percent.



Growth of urban and built-up areas is projected to continue at about 1 million acres per year during the next 15 to 20 years. Trends of the 1950 to 1960 decade indicate that the largest percentage gains in urban population, as well as in urban and built-up areas, were in the South. Smaller increases in both urban areas and urban population occurred in the West, and North Central regions. The smallest gains both in urban areas and population occurred in the Northeast. The South and the West are expected to experience substantial increases in areas devoted to urban uses. A high projected rate of population growth of the South, combined with a large, but declining rural population, may be expected to result in a substantial increase in land devoted to urban uses. A continuation of the shift in population to the West will expand areas devoted to urban uses in that region. More moderate increases may be expected in the North Central and Northeast regions. In all regions, an ample land base exists for expansion of urban areas. The main problem is to guide the expansion to establish well-planned communities, to provide an orderly transition of land from other to urban uses and to balance the growing need for urban land with the need to preserve sites of outstanding recreational potential of scenic or historic value.

Judging from past trends and the availability of public lands, the largest future growth in special land uses for recreation and wildlife is likely to be in the West. However, appreciable expansion will also occur in the South and North Central regions. The increase is likely to be moderate in the Northeast. The need to identify new sites for recreation and wildlife uses and to develop the potential of existing lands in those uses, is greatest in the Northeast, though by no means exclusive to that region.

PART IV. CHANGES IN THE CHARACTERISTICS AND STRUCTURE  
OF THE RURAL ECONOMY

It appears obvious that farming and the structure of the rural economy will continue to change rapidly in the years ahead. The downward trend in farm numbers is expected to continue. Little change is expected in the total land base required for agriculture and it is anticipated that a substantial increase will occur in the average size of farms.

Cash receipts from marketings are expected to be up from current levels by as much as one-third by 1980 due to increased output. The increase in gross farm income will be less, due in part to less nonmoney income with fewer farms and the assumption of lower Government payments. Production expenses are projected to rise, though less rapidly than during the last decade. The projected increase in net farm income would be rather modest. With the downward trend in farm numbers, however, income per farm would increase at a more rapid rate than per-capita income for the general economy.

Changes in tenure arrangements to accommodate reductions in number of farms and meet larger per farm fixed and operating capital requirements include an increase in the proportion of part owners and a reduction in the proportions of full tenants. Little change is expected in the proportion of farms operated by full owners. Family farms, defined as those using less than 1.5 man-years of hired labor, are expected to retain their dominant position in agriculture.

The rural population was practically unchanged between 1950 and 1960. Although some increase from recent levels may occur, it is unlikely to be substantial. Farm population, which currently represents about 7 percent of the total is expected to decline to around 4 percent by 1980.

With a decrease in farm employment and some increase in the rural labor force due to greater participation by women, there will be increasing need in the years ahead for the creation of new nonfarm employment opportunities in rural areas. It would also appear necessary for at least four-fifths of the youth reared on farms to find jobs outside of commercial farming.

Many towns and smaller cities in rural areas are likely to encounter continuing problems in maintaining prevailing volumes of business in the face of improved access to larger trade centers by local residents. Difficulties may also be encountered in maintaining adequate levels of educational, medical and social services in agriculturally dependent communities.

The adequacy of land resources to meet food and fiber requirements should facilitate shifts in use to accommodate both resource conservation needs and expanding nonagricultural requirements. It should also permit greater emphasis on improving the attractiveness of the rural countryside.



The influence of public programs on private lands is expected to increase in the years ahead. This is likely to result from greater emphasis on resource planning, zoning and other land use regulations, and increased public assistance in shifting uses and developing resources.

Selected facets of the situation that have a bearing on resource policies and programs are discussed in greater detail in the following sections.

### Number, Size, and Tenure of Farms

Farm numbers declined rapidly in recent years, the total number declining by 11 percent from 1950 to 1954, and by 23 percent from 1954 to 1959. If these trends persist, the number of farms would decline to just over 2 million by 1980. It is expected that about one-half would have farm sales of \$10,000 or more, compared to about one-fifth in 1959, and less than one-tenth in 1950. The remainder would be primarily part-time and part-retirement farms (table 41).

Table 41.--Number of farms by economic class of farms, 1959 1/  
and projected 1980 2/

Economic class	1959		Projected 1980	
	Number	Percent	Number	Percent
	<u>1,000</u>		<u>1,000</u>	
Sales of:				
\$40,000 and over-----	102	2.8	225	10.8
\$20,000 to \$39,999-----	210	5.7	410	19.6
\$10,000 to \$19,999-----	483	13.0	425	20.4
Total \$10,000 and over--	795	21.5	1,060	50.8
\$5,000 to \$9,999-----	654	17.6	200	9.6
\$2,500 to \$4,999-----	618	16.7	75	3.6
\$50 to \$2,499-----	349	9.4	50	2.4
Part-time-----	885	23.9	300	14.4
Part-retirement-----	404	10.9	400	19.2
Under \$10,000-----	2,910	78.5	1,025	49.2
Total all farms-----	<u>3/ 3,705</u>	100.0	2,085	100.0

1/ Census of Agriculture.

2/ Daly, R.F. "Agriculture in the Years Ahead," talk presented at the Southern Agricultural Workers Conference, Atlanta, Ga., Feb. 3, 1964.

3/ Excludes 3,000 abnormal farms.

The movement of farms into the larger size classes would result in further concentration of production in the upper size classes. By 1980, farms with sales of \$10,000 and over could account for as much as 95 percent of total output, compared to 72 percent in 1959, and utilize as much as 85 to 90 percent of all cropland compared to about 75 percent in 1959. Productive assets per farm for farms having sales of \$10,000 or more would be up about 25 percent from the \$120,000 level of 1962.

The tenure distribution of farm operators and of farmland will be shaped by the size pattern that emerges. Assuming that present trends continue, part owners will increase in relation to other tenure classes, making up as much as 40 percent of all farms and operating two-thirds of all land in farms. Full owners may continue to make up one-half or more of all farm units, and full tenants to decline to 10 percent or less of the total.

A varied regional pattern characterizes the tenure adjustments that have been occurring. Tenant-operated farms, more than part- or full-owner-operated farms, are susceptible to the economic pressures for consolidation. Unlike other regions, tenant-operated farms in the South persistently have been smaller than full-owner-operated farms; since 1950, the rate of decline in tenant-operated farms in the South far exceeds that of other regions. Approximately one-half of all tenant-operated farms are still found in the South, however, and their decline may continue to exceed the national rate for the group.

The three regions, North, South and West, do not differ greatly in the relative change of full-owner-operators over the last two decades. Part-owner-operators increased in numbers from 1940 to 1950 in all regions, but at a much higher rate in the South than elsewhere. After 1950, all regions experienced a slight decline in number of part owners. Available data do not indicate the amount of movement between tenure groups, although it appears likely that a net movement of tenants into the part-owner group occurred during both decades and that a net shift of full owners to part ownership occurred after 1950. Whether, or how, these trends will continue will be determined by economic forces affecting farm operation, the extent to which satisfactory financial techniques are developed for aiding tenure adjustments, and interregional production shifts. Too little is known about the feasibility of corporate organization for farms to predict its future extension, although the number is expected to increase.

#### The Rural Labor Force

The number of rural people employed solely or primarily in farming declined by almost 2 million between 1950 and 1960. If this rate of change is projected to 1970, the number of persons engaged in farming would be about 3.7 million, compared to 5.1 million in 1960, and 7.0 million in 1950. By 1980, farm employment will probably be down about 25 percent from 1970.



The number of rural people employed in nonfarming activities increased by 1.6 million in the 1950's, a 5-percent increase for men and a 38-percent increase for women. Estimates of rural employment in 1950 and 1960 are presented in table 42.

Table 42.--Rural employment by occupation,  
1950 and 1960

Occupation	1950	1960
	(Mil.)	(Mil.)
Farming-----	7.0	5.1
Nonfarming-----	12.0	13.6
Unemployed-----	.7	1.0
Total-----	19.7	19.7

Assuming the same rate of migration of labor from rural areas in the 1960's and 1970's as in the 1950's, the rural labor force by 1980 may rise somewhat above 1960, due mainly to the greater participation of women in the labor market. Changes in national economic growth and urban labor markets, and changes in the rural economy could significantly affect the rate of outmigration.

The projected decline of employment in farming is consistent with past trends and with the projected decline in farm numbers. The chief source of decline in farm employment will be operators and family workers on small farms. A reduction is expected in the number of part-time and part-retirement farms with part-time operators accounting for most of the decline in employment. Economic underemployment would be concentrated mainly among operators of small commercial, part-time, and part-retirement farms, and among hired workers on all farms.

If rural areas have no outmigration and rural women participate in the labor force as projected, the total rural labor force would be significantly higher by 1980, and be accompanied by severe unemployment.

Whether or not outmigration from rural areas will proceed as projected depends upon several factors. First, national job markets are increasingly discriminating as to education and skill. Rural people, at least the older ones, are not as well educated as urban people in the kinds of skills required for jobs in the growing sectors of the national labor market. Second, cities are now producing more labor than they are absorbing. This means that rural people who seek jobs in cities face increasing competition from a population generally better trained and better acclimated for the urban job market. Third, it is increasingly difficult to absorb

labor due to greater use of capital and the higher productivity of labor that is employed. The extent to which unemployment and underemployment of rural people can be reduced will depend heavily upon the demand for labor in the total economy and the ability of rural people to compete for jobs. It will depend, too, on the continued growth of employment opportunities in rural areas, and the adequacy of these opportunities in offsetting reduced future employment in farming.

### Public Participation in Resource Management

The structure of the rural economy is greatly influenced by concerted public planning and action programs. Public participation in resource management occurs at all levels of government. The need for this participation grows out of the increased competition between various types of land users for control of space and from the efforts to achieve production adjustments.

Public participation in resource management takes several forms and differs by level of government. Governmental financing of specific action programs has been one of the more common forms, particularly for Federal programs, although other techniques are widely used. Resource planning, as an aspect of management, is likely to be applied in more situations.

Some of the projected major shifts in land use would be either achieved or strongly influenced by specific programs--Federal, State or local. Public participation or intervention may be involved in implementing both the projected 43-million acre shift to special-purpose uses, and the 41-million acre reduction in cropland.

It is not likely that State or local governments will participate significantly in achieving cropland shifts. They will, however, continue to be primarily responsible for planning and directing patterns of urban growth, although several Federal programs also assist in urban development. No single pattern of Federal-State-local participation exists in urban planning and development. Some Federal programs to aid urban development are channeled through States, but there are important exceptions. Public housing, public-facility loans, urban renewal, airports, and metropolitan planning are not generally channeled through or directly controlled by the States. Also, some Federal programs have encouraged or tended to result in the creation of special districts or public authorities, such as for soil conservation and watershed control which are common in rural areas, and others, such as for public housing and urban renewal that serve specific urban needs.

Open-space programs, including acquisition of additional land for outdoor recreation, are being undertaken in several States, and have Federal, State and local support. The impetus for these programs is closely related to needs for expanding urban growth. Most of the programs undertaken so far have operated under very general guides. More intensive planning may prove feasible as better information is obtained about the needs, costs, and type of facilities required. In part, the space needs may be supplied from converted cropland although it is expected that much of the land will come from noncrop uses.



In view of probable expansions in programs by all levels of government that involve the acquisition of land for reservoirs, parks, recreation areas, fish and wildlife preserves, highways, access roads, public building sites, open space, and others, it appears essential that increased attention be given the adequacy and equitability of procedures governing public acquisition of private land and provisions for compensation.

#### Other Prospective Changes

Numerous other changes in the characteristics of rural areas appear to be in prospect. It seems likely that an increasing share of the income of persons living on farms will come from nonfarm sources. This would be expected to be particularly the case for small commercial farms, and part-time and retirement farms.

There is also likely to be a continued increase in specialization in agriculture, due to both the need for particular skills and for specialized types of capital. A related development would be a continued increase in services performed outside of agriculture. As a corollary, there is likely to be an increasing amount of interdependence between agricultural and non-agricultural sectors of the local economy, as well as between agricultural production areas.

Due to the substantial capital investment requirements, acquisition of ownership of commercial farms by farm operators is likely to become increasingly dependent on inheritance and family help, and a larger proportion of the ownership of leased commercial farmland is likely to be held by nonfarm business and professional groups.

The gap between farm and urban levels of living is likely to be reduced substantially in the years ahead. Improved technology has increasingly made many conveniences and facilities that were formerly limited to urban areas readily available to farm homes.

PART V. CONTINUING PROBLEMS AND ISSUES 1/

Although the abundant productive capacity of agriculture must be regarded basically as a social asset, its management has long posed the problem of assuring equitable returns to the agricultural sectors of the economy at the same time that public needs are served. This problem is not likely to solve itself within the next couple of decades. Experience with the variety of farm production, price-support and land-use programs that have been put into effect since the 1930's indicates that no single or simple solution is possible.

Although consideration of agricultural policy as a whole is beyond the scope of this report, attention must still be given to the manner in which resource policies and programs can contribute to the attainment of appropriate agricultural policy goals. In this setting, land-use adjustment and other resource-related programs are regarded as but a part of a broader set of agricultural programs and, hence, should be designed to complement other features of the comprehensive program.

Considerations in Designing Resource Adjustment Programs  
as Adjuncts of Comprehensive Agricultural Programs

The chief land-use adjustment devices used during the last decade or more in coping with problems caused by excessive production capacity have been acreage-allotment and marketing-quota programs, the acreage and conservation reserve of the Soil Bank programs, and the wheat and feed grain diversion programs. Attempts to restrict total output through these devices have not been sufficiently effective to bring supply into balance with demand.

While acreage allotment programs have raised prices and farm incomes above levels that otherwise would have prevailed, their impact on output often has been less than anticipated. Many contend that the combination of price supports with acreage controls has frequently induced more intensive production practices, with the result that increased yields on the acreage in production has often offset the effect of the acreage reduction. Others argue that efforts to maintain income under lower prices would also stimulate more intensive practices and increased output. In case both are right, we are faced with the dilemma of surplus production either with or without a program.

The cropland diversion programs also improved the agricultural situation from what it otherwise would have been. The reduction in production, however, has been considerably less than the acreage withdrawn by such programs. Apparently, a substantial proportion of the acreage under such programs was of less than average productivity, and there was some shift in the use of labor and machinery to more intensive practices on lands remaining in production.

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1/ As indicated in the Introduction, the views expressed in this report are those of the task force and not necessarily those of the Committee. This disclaimer clause is particularly applicable to the many controversial statements contained in this Part.



Some type of government program to assist agriculture in making an orderly adjustment of production in accord with requirements is essential. The general alternative of no program is ruled out, since it would result in a drastic reduction in farm incomes, would seriously impair rural well-being, and would adversely affect the entire economy. Undue economic pressures would be brought to bear on moving people out of agriculture in advance of either adequate alternative job opportunities or suitable training to fill jobs of the type likely to become available. Those able to survive in agriculture would suffer serious income and capital losses, accompanied by diminished purchasing power and reduced levels of living.

The following appear to be among the several conditions that a land-use adjustment or other production-control program should strive to meet in order to be reasonably effective and acceptable:

1. It should be reasonably effective in curbing production and raising farm incomes, without jeopardizing utilization outlets. The operation of the program should be such as not to induce offsetting increases in production on other acreages or in other areas, and yet not discourage efficient production practices. In this respect, quantity-type quotas and controls would have an advantage over acreage controls. At the same time, there is need to guard against raising prices to a level where commodities are unable to compete for foreign markets or with nonagricultural substitutes in the domestic market. Perhaps combinations of production-curbing measures with either multiple prices or income-support payments have possibilities for achieving the type of balance desired.

2. Land-use adjustment programs should provide sufficient flexibility to permit a range in participation in accordance with particular situations.

3. The program should be reasonable in terms of government costs. The costs of agricultural programs have been increasing, and appear to be reaching the upper limits of legislative acceptability. A related question concerns the distribution of program costs between such groups as processors, consumers, and taxpayers. Government costs are not a sufficient single criteria for judging the merits of particular approaches. Equivalent consideration needs to be given costs borne by consumers or other groups, with particular attention to the impacts of various incidence patterns on regional and national economic growth.

4. Resource-use adjustment programs must take account of both more immediate and longer-term resource requirements. Lands suitable for continuous crop production that are diverted in the interests of reducing surplus production should be held, insofar as practicable, in a use that will permit eventual reconversion to crop production. A few decades is a short span in the life of a nation and to the extent feasible, irreversible shifts should be avoided.

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5. Attention needs to be given numerous types of side effects that may have adverse impacts on various sectors of the economy. This includes such effects as adverse impacts on local economies, other agricultural enterprises, and the resource tenure structure. Particular attention needs to be given the relation of a specific program to other agricultural programs and to various aspects of national policy. A critical question that has been raised on many farm programs concerns the likelihood of their becoming capitalized into land values and thus subject to appropriation by present owners.

The difficulty of meeting the combined conditions listed explains in part the slow progress that has been made over the last three decades in developing programs that are both effective and mutually acceptable.

#### Production Restrictions Versus Activities Expanding Productive Capacity

The question is often raised as to why the Government undertakes both production restriction programs and activities that result in expansion of productive capacity. This type of question defies a simple answer.

The Department has taken the general position that resource policy should provide for the orderly improvement of cropland through carefully selected means and measures, along with resource adjustment programs designed to bring production into accord with utilization. Thus, resource development and resource adjustment are both considered essential for a balanced program to realize continuing maximum benefits from the use of land and water resources. Implicit in this position is recognition that the production of additional farm products is only one of the considerations involved, and not always the controlling factor. Other objectives include lower production costs, reductions in drought and flood damage hazards, income stability, provision of opportunities for establishing efficient family farms, promotion of rural-area development and regional economic growth, increased variety and flexibility of crop and livestock enterprises, and resource conservation.

Production-increasing activities may be grouped into three major classes: research, education and planning concerned with the development and application of improved practices and programs; damage prevention, such as from floods, erosion, droughts, and insects and pests; and land reclamation, such as through irrigation and drainage. There would appear to be fairly significant differences in the justification for government participation in each type, although all may result in aggravating the production surplus situation.

#### Research, Education, and Planning

The main purpose of this group is that of creating a highly productive agriculture in which resources are efficiently used. Although some benefits may accrue to farmers, the bulk of the benefits of such programs eventually go to consumers and the public-at-large in the form of an abundant supply of food and fiber at relatively low cost. Programs in this group have made it



possible for agriculture to contribute significantly to economic growth through low food costs, the release of manpower for industry, the provision of aid to needy countries, and generally improved levels of living through improved quality, variety and more orderly seasonal distribution patterns.

Despite contributions to surplus production, the social advantages of an efficient productive system clearly outweigh the problems created. The provision of abundant food at reasonable prices is a major reason for public interest and concern in agriculture. Due largely to this group of activities, the food situation of consumers is better in the United States than in any other country, the importance of agricultural exports in supporting our balance-of-payments situation has been maintained and farm products provide a significant source of aid to undeveloped countries. The benefits of efficient production are sufficient to warrant placing primary reliance on means other than restricting efficiency in treating the surplus problem.

### Damage Prevention

Although agricultural damage prevention can contribute significantly to resource efficiency, the primary basis for justifying public assistance often rests on stabilizing incomes and avoiding losses that would be unduly burdensome to the individuals involved. Often damage prevention also has significant implications for resource conservation, particularly where the productive capacity of the resource base is subject to impairment.

If productive efficiency is considered a major dimension of welfare, damage reduction activities may be regarded as being mainly concerned with another dimension, that of distribution. Farmers and others are considered to be better off if they are in a position to earn a steady income year after year. Severe damages for a year or two would result in catastrophic losses from which many would be unable to recover. The severity of such losses may far outweigh contributions to surpluses resulting from damage-prevention programs. Thus, even though flood damage prevention programs may aggravate surplus problems, this becomes rather an incidental consideration, since the losses incurred by those suffering damages may be extremely severe in comparison to the rather widely dispersed and negligible contributions to surpluses. Many damage-prevention activities would thus appear to be warranted on their merits in preventing the concentration of undue hardships regardless of the production surplus situation.

### Land Reclamation Through Irrigation and Drainage

Arguments for land development in the face of surpluses must rely on such considerations as providing more efficient family-farm units, promotion of rural-area development and regional-economic growth, increasing the variety and flexibility of crop and livestock production, and to a limited extent, some possibility of reductions in production costs.

In addition, some land development is an integral part of most multiple-purpose projects. Some type of land enhancement is almost bound to accompany flood prevention. Also, if provision is not made for potential irrigation at the time of project construction, future irrigation may be precluded or made more expensive. At least in some regions, new land development may be needed to replace land absorbed by urban expansion, or to replace land unsuited for continuous cultivation.

In any case, the justification for new land development must rest on other grounds and can no longer be based primarily on meeting the growing food requirements of an expanding population. The estimates of new cropland development contained in this report, including the increase in acreage under irrigation, represent expectations based primarily on extrapolations of past trends. The increases are considered probable in the light of influences likely to affect irrigation and other forms of development. They do not represent estimates of development needed to meet expected requirements for farm products during the period. The expansion in cropland development would intensify problems of downward production adjustment in achieving a balance between utilization and supply.

The main interest in new land development through drainage and irrigation generally stems from local or regional sources. In terms of national interest, it would appear preferable to defer actual new land development pending the growth in product requirements. Justification for such activities depends primarily on achieving benefits in the form of improved regional or individual income distribution patterns, rather than on the additional product produced.

#### Program Costs

Principal concern in recent years has been expressed over levels and trends in government costs of agricultural programs. The acceptability of several alternatives that would reduce such costs, however, has been rather lukewarm.

Government costs could be materially reduced through compulsory production-control programs. The bulk of the costs of an effective compulsory program would be borne by consumers. Two price and processing certificate programs also operate to shift more of the costs of programs to consumers.

Voluntary programs are generally considered to be the most costly in terms of government costs. The payment for restricting acreage or production must be sufficient to induce participation, and the government outlays are accordingly generally greater. Although a part of the costs of an effective program may be borne by consumers, the heaviest share of the costs is borne by the taxpaying public. A possibility for reducing the government costs of programs would involve limiting price support and acreage diversion payments to specified quantities or amounts for any particular farm. The result would, of course, result in quite a different type of program from prevailing and past programs. The emphasis would be on maintaining specified minimum income levels for smaller family farms. Participation by larger producers would likely be substantially lower.



The whole question of the incidence of the costs of various types of production restriction programs is, however, in need of thorough study. A better understanding of the incidence problem is essential for making considered choices among alternative programs.

The distribution of costs of resource-development programs is somewhat less obscure. Many of the benefits and costs of such programs are subject to identification and at least approximate estimates may be made of incidence patterns.

The extent of national interest and concern in resource-development programs depends on the nature of benefits, their dispersion and potential alternatives for providing project services.

Of substantial national interest are types of benefits that improve health and welfare and encourage economic growth, and that in turn accrue either to the Nation as a whole or are shared by most sectors. A significant level of Federal interest accordingly attaches to such effects as strengthened national security, maintenance of high employment levels through provision of new investment and job opportunities, encouragement of a wide dispersal of industry and balanced regional development, provision of adequate food, fiber and energy at reasonable prices, conservation of resources, preservation of areas and species of aesthetic and scientific value, and expansion of opportunities for fishing, hunting and other forms of outdoor recreation.

Many resource development benefits that accrue directly to individuals and local groups likewise improve the general welfare and are therefore also in the public interest. However, the concentration of the benefits involved may often be such as to reduce the amount of the Federal contribution that would otherwise be justified. Where benefits accrue to identifiable primary and secondary beneficiaries, the absence of charges and assessments for project or program services would result in particular individuals, enterprises, groups and areas gaining much more from resource development than would other sectors of the economy. Considering only the desirability of an equitable distribution of gains throughout the economy, specially benefitting groups should be required to bear financial responsibility corresponding to either the value or the costs of services received.

The extent of public interest attached to particular purposes is also influenced by alternatives available for supplying comparable services and the likelihood of such services being supplied in the absence of Federal assistance. The probability of similar services being provided by either private sources or State or local agencies would reduce or eliminate the need and justification for Federal contributions.

Other factors affecting amount of Federal interest and corresponding contributions include the extent of spillover effects that accrue to other areas and which are thus difficult to assess and capture by local sponsors; the magnitude of the undertaking in relation to the financial ability of non-Federal groups; the extent to which projects and programs are modified

in the interests of achieving other national public policy objectives such as preferences for types of users and sizes of enterprises; the probability that projected benefits will be realized, including allowances for new demonstration and experimental types of development; and provisions for meeting international obligations.

### Other Problems and Issues

The following are illustrative of other problems and issues in need of clarification as the first step in developing possible solutions:

1. Agricultural uses versus competing requirements for resources. This problem is encountered in urban expansion, highways, recreation, and particularly in water-resource development and use.
2. Institutional obstacles to orderly resource management. Resource development and use is influenced by a wide range of institutional factors, varying from the existence of small farms in private ownership that are dependent on poor land, through State-administered resource laws, to various types of interstate compacts and international treaties. Many such institutions operate to limit or constrain optimum types of development or shifts in resource use.
3. Reconciling differing objectives of interrelated programs. Most resource programs have multiple objectives and there is always the problem of developing an appropriate balance between competing uses, users, sectors, areas, and over time.
4. Justified investments in flexibility and provision for contingencies. As has been indicated elsewhere in this report, estimates of resource requirements at any specified time cannot be made with a high degree of assurance. The projection becomes less reliable the more remote the time. Two types of action may be used to cope with future uncertainty. One involves incorporating sufficient flexibility in resource projects and programs to permit adjusting as needs change. The other is to make provision for a sufficient contingency reserve of resources to meet demands when they arise. A better basis is needed for answering such questions as "How much should be invested now to meet future contingencies?" Or perhaps the question should be in the form of "What would be the cost of not having a resource contingency reserve available when needed?"
5. The effect of land-use adjustment on efficiency. It has been argued that removing land from production results in inefficient resource use. In this view, land with limited alternatives is considered essentially a free good from a



social viewpoint and is wasted if not used. If production is to be curbed, it would appear preferable to permit the use of all available land and shift such inputs as production materials or capital to other sectors of the economy where they could be used more advantageously.

This position would have considerable merit if quantity controls could be feasibly applied. The relative ease of administering land controls is likely to result in continuing emphasis on regulating this input. Also, resource adjustment programs must take account of the situation prevailing at the time they are initiated, including the effects of previous programs. Thus, decisions concerning a program permitting the unrestricted use of land would need to take account of its impacts on the prevailing land value, mortgage commitments, and the ownership structure.

PART VI. POLICIES AND PROGRAMS

Recommended Land and Water Policy for the  
Department of Agriculture

The all-embracing goal of land and water resources policy is to achieve types of resource use and patterns of resource management that will make the greatest contribution toward improving the well-being of both present and future generations. Such a comprehensive goal has several dimensions and numerous facets. It includes the provision of a continuing abundance of food and fiber at reasonable and stable prices for the people of the United States, the promotion of our interests in world peace through trade and assistance, opportunities for efficient farmers to earn incomes comparable to other sectors, an equitable sharing of the benefits and costs of resource programs among concerned interests, appropriate regional and time patterns of orderly resource development and use, effective stimulation of area and national economic development, improved quality of resource services, and others. In order to guide Departmental resource programs and activities, the following series of recommendations are considered to reflect the main components of an attainable policy toward which an effective contribution can be made.

1. The general objective of the Department of Agriculture is to encourage land and water uses that will yield continuing maximum benefits to the people of the United States.

This involves the economical production of food and fiber in quantity and quality sufficient to provide a satisfactory standard of living, to serve as a sound base for economic growth, to enable the Nation to carry on foreign trade and assistance at effective levels.

The land, water, and forest resources of the Nation are vital to sustaining and improving the health, safety, and economic well-being of its citizens. National programs should be directed at the conservation, development, and management of these resources to support a balanced and strong economy, and to provide an attractive rural countryside for the enjoyment of all.

Present and future programs should be designed and directed to ensure that conservation aims and balanced farm output are achieved at the same time that farm income and opportunity are improved.

Adjustments in land use to balance output and needs should be made in ways that will have the least adverse effect on farming efficiency and will make land and water available to an expanding population for living space, industry, commerce, and recreation.

In the conservation, use, and development of water as a resource, and in the conservation of agricultural lands, the upstream watershed should be regarded as one of the most important bases upon which to plan and build for present and future needs of urban as well as rural residents.



On the National Forests and the National Grasslands the Department should continue to provide for, and ensure the administration of, a multiple-use sustained yield program of resource conservation, development, and use.

The Department's program of financial assistance to farm families and other rural residents should be augmented to permit them to take advantage of available opportunities for improved well-being.

The Department should continue a vigorous comprehensive program of research in land, water, plants, and wildlife conservation and development. Programs to ensure the timely application of research findings should be continued.

The foregoing steps will help the Nation to achieve widespread and equitable distribution of farm, forest, and recreation income through a system of owner-operated family farms, forest holdings, and recreation enterprises; and to keep crop production in balance with domestic and export requirements.

2. Adequate income for farmers should be an immediate and continuing objective.

Through its several programs of technical, financial, and other forms of assistance, the Department should seek to enhance the opportunity for the farmer to earn an income from farming comparable to that of other occupations.

The efforts at production-management and price and income support should be consistent with long-run land-use adjustments and with land and water conservation.

Cost-sharing and technical assistance, as well as reasonable compensation for needed shifts in land use, should be available to farmers cooperating in the production-management and conservation programs.

The Department should give special attention to developing new uses and sources of income such as the recreational uses of land, water, forest, grass, and wildlife resources, in ways that will contribute to the economic stability of farm families.

3. The conservation and efficient use of land and water resources should be carried on as one of the urgent and continuing needs of agriculture and other sectors of the economy.

The systematic use of proven soil, water, range, forest, and wildlife habitat conservation techniques should be encouraged to avoid costly erosion of soil, to protect and develop land resources for future uses, to manage soil and plant resources for efficient and continuing production of food and fiber for human needs, and to protect and improve watersheds and water resources for both agricultural and urban uses.

Since demand and production in the future cannot be foreseen with certainty, land, water, and forestry programs should be flexible. Productive soil resources not now needed for cultivated crops should be kept stable and available.

Department land and water programs should proceed according to the scientifically proven principles of good land use based on soil surveys. These programs should be designed to achieve needed treatment of eroded and depleted soils; protect land against erosion and other deterioration; protect and improve forests, farm woodlands, and grasslands; conserve moisture; reduce flood and sediment damage; improve the quality and dependability of water yields; apply conservation techniques in the management of water; and increase overall farming efficiency. Conservation of agricultural lands should be encouraged through technical assistance, credit, education, and the sharing of costs with the farmer.

The planning of water and related land resources in river basins should include consideration of needs in upstream watersheds. Consideration also should be given to opportunities to meet those upstream needs and to contribute to meeting downstream needs by appropriate upstream watershed developments. Such developments should be coordinated with major works proposed for construction on the mainstem and major tributaries.

The protection and development of entire small watersheds, fitting together the management of crop, range, and forest lands, and the treatment of watercourses to minimize flood damages and sediment yields, to encourage the movement of water into the soil for plant use, and to improve the quality and dependability of water supplies for all potential uses, urban as well as rural, should be a continuing objective. The enterprise, judgment, and leadership available in communities should continue to be utilized in the planning and execution of individual projects.

In the areas of the Nation that have the more serious land-use problems and greater agricultural hazards, special provision for land adjustment, for research, for the conservation treatment of land, for education and demonstration, for credit, and for measures to achieve steady economic growth should be encouraged.

Programs for the conservation, use, and treatment of land and water resources and the making of needed adjustments should take into account the problems of people who use the land to earn a livelihood.

The Department recognizes the fact that wilderness is a relatively scarce resource. The National Forest Wilderness System has been established to protect millions of acres that have been judged to be predominantly valuable for wilderness. The use of established wilderness and wild areas and the Boundary Waters Canoe Area should be maintained until there is clear evidence favoring a change.



The Department recognizes that Wildernesses are needed as a part of the American heritage and for the well-being of a modern society. The Department also recognizes that wilderness areas are relatively scarce. Studies to evaluate their wilderness character and value will reflect the overall national need for wilderness areas, the potential supply of such areas, and other resource values and public needs. The Department should endeavor to maintain and preserve existing primitive areas and prevent their use for nonwilderness purposes until final evaluation and classification is completed.

As one of the largest users of water, agriculture has a responsibility for its conservation and efficient use. Many studies show that the efficiency of agricultural water use could be greatly improved, yet trends of the last decade indicate that limited improvement has been achieved.

The Department should encourage the application of present knowledge and undertake cooperative research on problems of agricultural uses of water and institutions affecting water use. States should be encouraged to adopt equitable water-use laws that clarify rights to use water resources and promote optimum use. Development of water resources should recognize present rights of water users. As uses of land are changed to fit altered conditions and meet new needs, water requirements can be expected to change. Changing situations may necessitate adjustments in State water laws and their administration.

The National Forests and National Grasslands should be managed to improve the quality of water produced from such lands. These lands also should be managed to increase the quantity of water produced when this has been determined to be in the best public interest.

Technical and cost-sharing assistance and credit should be supplied to help landowners promote conservation in water use on farmlands, and promote water yields of higher quantity and quality. This is especially significant where these lands are in agriculturally important watersheds from which supplies for urban and other users are drawn.

4. Efficient farming operations and widespread and equitable distribution of income should be encouraged.

In a world of technological revolution, the most advanced technical processes must be adapted to the family farm unit. This is an objective of basic and applied research in agricultural technology. The Department should direct its production research efforts to the continued improvement and adaptation of technology to family-type enterprises. Technology must be adapted to serve man. Extension, technical and financial assistance, and credit should be used to stimulate the application and research results on the family farm.

A balance between supply of farm products and needs should be sought through the use of land within its capability and through the diverting of land from production of crops beyond current needs.

Land diverted from use in crops should be given appropriate conservation treatment in the new uses.

Increasing efficiency in the family farming operation can be expected to result in lower unit costs of production. Practices to be emphasized should include combinations of those which will maintain high soil productivity and high efficiency in soil-plant-water relationships, make use of improved plant varieties, and provide for protection against diseases, insects, and weeds. Farming practices known to reduce the capacity of soils for sustained efficient production should be discouraged.

Opportunities in forestry for family farming enterprises should be encouraged. Development of recreation and wildlife resources as a phase of family farm operation should be stressed where appropriate.

This Department should strengthen its programs to improve management and technologies adapted to family-type operations. The Department should continue to provide educational opportunities, and technical, credit, and financial assistance for this purpose.

The flood plains of small watersheds represent one of the opportunities for protection, improvement, and diversification of farm enterprises. Because of flood threats and erosion, such lands are seldom used effectively for crops or other purposes. With the more efficient and varied uses of these acreages as objectives, and with other important advantages accruing to rural communities from watershed projects, the Department program of watershed protection and flood prevention should be pressed. Such an effort should be used to adjust and stabilize the economies of family farms and of communities. A broadened watershed program including forestry, recreation, wildlife management and scenic enhancement will accomplish much toward obtaining optimum use of these flood plain areas.

As with flood plains, the development of wetlands should be considered under a broad program including farming, forestry, recreation, and wildlife management. Technical, financial, and credit assistance should be made available to family-type enterprises to encourage appropriate wetland management. In this program, all services of the land for current and future uses should be carefully weighed.

A system of family farms has a major contribution to make to a healthy and vigorous national economy. The farmer, too often the victim of climatic conditions and of price declines beyond his control, is an important factor in the overall economic structure. Reasonable provision should be made to safeguard his economic well-being as a citizen, as a producer, and as a customer and user of a large portion of the national product. The historic objectives of a family farm system of agriculture are as valid today as they were during the settlement of this country. We consider a family farm to be one for which the operating family furnishes the management and most of the labor required.



It is the policy of the Department of Agriculture to encourage efficient family enterprises, first, by developing management, production, and marketing techniques designed for the family enterprise; second, to make available credit and financial assistance as may be needed to keep family farms in healthy condition with returns adequate for the needs of the family; and, third, to provide ownership credit so that qualified farm youth without adequate financial resources may have access to farm ownership. The Department should administer its many programs to promote the family farm and should explore with State authorities the possibilities of strengthening family farms through appropriate institutional and educational devices.

5. The Department should expand its technical service and planning participation in rural and urban expansion areas.

Major land-use changes accompanying the Nation's shift from a rural to an urban economy are creating new, and compounding existing, social and land-use problems. The press for new living space often may result in efforts to put some lands into uses for which they are poorly suited. Shifts from crops to grass and trees, or to urban, industrial, transportation, and other nonfarm uses, create many community problems.

The Department has a major interest in, and responsibility for, offering guidance and help in obtaining sound use of land and water resources and patterns of rural residence that will facilitate provision for community, educational, health, and other services. The Department, therefore, should increase its efforts to furnish technical information on soils, water, and land uses to State or local organizations responsible for community planning and development.

This service should include: (a) The provision of accurate information on soils showing their suitability for specific purposes, including high-value agricultural use; (b) assistance to State and local planning groups in interpreting information on soils; (c) assistance to local governments and other organizations to understand opportunities and limitations in the watershed protection and flood prevention program; (d) information to Federal and State agencies on land and water use planning, land management, reservation of open space and recreation areas, rural zoning, and other means to prevent occupancy of lands creating problems involving health, safety, or high-cost services; (e) technical assistance to owners of rural land to make needed adjustments and achieve proper use and treatment; and (f) cooperation with other Federal departments to encourage proper use or development of all rural lands. Particular stress should be placed on treating farm and area plans as an integral part of more comprehensive planning activities.

In some areas of the country inappropriate use of land and water resources, inadequacy of the size of farm units, and abandonment of rural areas through outmigration will justify a rural renewal approach. In such instances, adjustments to provide adequate family-type farm units may be the most feasible solution. Land not suited to cultivated crops should be used for forestry, for grazing, for recreation or a combination of these uses

Department representatives should cooperate with State and local authorities and make available the services of specialists in dealing with individual and community problems growing out of the changing uses of land and water resources.

Information gathered through soil surveys on the suitability of certain soils for various uses related to urban development should be made available to persons concerned with urban expansion programs as well as those involved with agricultural uses of land resources.

Assistance in planning open space and recreational areas within easy access of urban centers should reflect consideration of the values of land and water resources in various uses.

In conversion of agricultural land to urban and related uses, the Department should discourage practices which invite erosion and high maintenance costs. Developers, builders, and planning agencies should be encouraged to make use of information available through soil surveys.

Planning and development on a watershed basis should be encouraged as a means through which optimum benefits from soil, water, forest, grass, and wildlife conservation may be achieved for both rural and urban residents.

6. The Department should increase efforts to reduce the harmful effects of water and air pollution, soil contamination, and pesticides and herbicides through research and application of improved technologies.

Dissolved salts, suspended sediment, and turbidity are among the principal impairments to water quality. Accumulation of salts and toxic materials in soils is one of the hazards of irrigated agriculture. Chemical solutes from unusually heavy fertilizer application on agricultural land may reduce water quality. The leaching of accumulated salts in irrigated soils with water of low salt content may increase dissolved solids in return flow and thus aggravate water problems for other users.

Silt or sediment from eroding agricultural lands, road cuts, suburban developments, and geologic erosion deposited in reservoirs, stream channels, on flood plains, or in municipal areas, represents tremendous economic losses.

The increasing pollution of air with gases, fumes, and solids has definite agricultural implications. Evidence is mounting that certain of these pollutants damage livestock and crops, including forest vegetation.

The greatly increased use of agricultural chemicals has been attended by certain problems. Unless properly used, pesticides can create hazards by contaminating foods, by endangering livestock, game animals, fish, birds, pollinating insects, and beneficial parasites and predators, and by affecting the soil and plants grown in the soil.



In the search for solutions to all of these problems, agriculture shares responsibility. Steps should be taken rapidly to identify hazards, establish safeguards, and develop improved technologies. The Department should cooperate with other departments, public agencies, and State and local groups to find needed solutions to these problems.

7. The Department should provide landowners with technical and financial assistance to develop, maintain, and improve the habitat for fish and wildlife on their lands and to develop recreational enterprises.

The Nation's privately-held lands, because of extent and variety, hold a major potential for meeting the wildlife conservation and production needs of the Nation. These private landowners are the principal custodians of the Nation's wildlife habitat. Incentives should be provided for them to manage their lands to preserve and increase wildlife populations for recreational and other uses.

Cost sharing and credit as needed should be made available for such practices as construction of fish ponds, for the planting of vegetation for game food and shelter, and for protection of this environment.

The Department should offer technical assistance to States or local agencies in the development of rural lands to supplement present acreages of public parks, State forests, game management areas, and public hunting grounds.

8. Greater stress should be placed on providing an attractive rural environment as a contribution to natural beauty.

Land- and water-resource programs should be used to the extent feasible for improving natural beauty, providing healthy and pleasant surroundings and providing opportunities for leisure and esthetic experience.

9. In formulating land and water programs, the Department should utilize all of its resources and authorities to assure optimum opportunities for people in rural areas.

As adjustments in land and water use occur, the Department should continue to utilize its resources and authorities to facilitate human adjustments. Land- and water-use adjustments should maximize the opportunities for full employment by families remaining on rural land. This will require technical and financial assistance to families to help them adjust the size or nature of their operations. Greater emphasis should be given to enhanced income opportunities in forestry and in recreational enterprises. Ways to increase nonfarm employment in rural areas should be sought and assistance given in their development.

Credit for adequate housing, domestic water supply, recreation facilities, rural businesses and industry, and electrification and communications services should be provided to encourage desirable patterns of rural living and to stimulate rural commerce and industry.

10. Greater emphasis should be placed on participation in planning at local, State, and national levels to provide for the conservation and wise use of land and water resources.

Satisfying the growing need for multiple use of land and water resources requires cooperation by all interests. All persons concerned must be made aware of the importance of maintaining proper balance between present and future needs.

Plans and programs should focus attention of local citizens upon the full range of solutions and adjustments. Single programs should be related to overall opportunities and requirements. Local citizens should be encouraged to participate fully in the planning and implementation of action programs. Strong local organizations should be promoted and kept informed of changing national conditions and of opportunities to adjust to future needs through timely community action. National programs should be integrated with local community plans, and local plans should reflect national needs and goals.

11. The costs of land and water programs should be equitably shared among benefitting interests.

Many interests in all sectors of the Nation share in the benefits of resource management programs, including consumers, producers, distributors, suppliers and the general public, and all such groups have a responsibility for sharing in the costs.

#### Land and Water Programs

A number of measures and programs would appear necessary to achieve the land-use adjustments likely to be needed by 1980. Several types of resource-oriented programs have a contribution to make in efforts to bring resource uses into balance with requirements, assure conservation, development and use of resources that will yield continuing maximum benefits, assist in making farming and other opportunities available in rural areas, and generally contribute to economic growth and the well-being of farmers. Principal groups of programs include those concerned with cropland conversion, resource conservation and development, land- and water-use planning, and resource surveys and research.

#### Land-Use Production Adjustments

Cropland in the 50 States totaled 458 million acres in 1959. Projected requirements for 1980 are calculated at about 417 million acres. This reduced amount of cropland is considered adequate to meet expanded export needs and provide an improved diet for a population of 245 million.

Farm production in 1980 is expected to be about 45 percent above 1959. With a continuation of recent trends in crop yields, the projected value of crop production per harvested acre for 1980 is 61 percent above 1959. Due mainly to these yield increases, projected food and fiber requirements can be met with a net reduction in cropland of about 41 million acres.



In considering the magnitude of the total shift by 1980, account also needs to be taken of an estimated 18 million acres of new cropland likely to be brought into production by that time. Thus, the total shift of cropland to noncrop uses would be 59 million acres by 1980. Since about 6 million acres would be absorbed by urban expansion and preemptive nonagricultural uses, the remaining 53 million would probably be in need of program assistance. In addition, a part of the shift to urban uses as well as, a part of the 6 million-acre shift to rotation pasture might also require assistance. Thus, the crop acreage on which there is likely to be need for some form of program assistance in shifting to noncrop uses by 1980 would total in the neighborhood of 55 million acres.

This will involve maintaining general patterns of cropland use over the next decade or more that are in approximate accord with those prevailing in 1962 and 1963. Total cropland used for crops in those years ranged from 330 to 336 million acres, compared with the projected need of 331 million acres in 1980. The acreage of cropland harvested was 288 million acres in 1962 and 293 million acres in 1963, compared with the projected need of 292 million acres in 1980. In effect, it would mean the diversion to noncrop uses of an acreage equivalent to the average under the 1962 and 1963 acreage diversion programs.

The reductions in acreage needs are computed in terms of acreages of average productivity. Diversion would need to be substantially higher in case programs attracted only acreages of lower productivity.

The only groupings of soils consistent throughout the U.S. are the groupings in the Land Capability Classification System. Although not designed for use as productivity ratings, studies have shown that capability groups may be used as approximate indicators of productivity. If the diversion program covered all cropland in capability classes IV through VIII, the size of the diversion program would need to be increased by from 35 to 40 percent to bring about a reduction in production equivalent to that of an average composite acre program. The size of a diversion program that included all land in the less productive capability classes would need to be in the neighborhood of 75 million acres to accomplish a reduction in production equivalent to 55 million acres of average productivity.

The design of a cropland conversion program would depend in part on its primary purpose. A program designed principally to treat conservation problems would attempt to remove the bulk of acreage presently used for crop production in capability classes V through VIII, together with perhaps one-third to one-half of the land so used in capability class IV. This would involve converting around 25 million acres in the class V to VII category, and an additional 15 to 25 million acres in class IV. While such a program would have some impact on output, such effects would be rather limited.

As indicated above, a program aimed primarily at reducing surplus production would need to convert from 50 to 55 million acres of cropland of average productivity to noncrop uses by 1980. The acreage that would need to be converted would be substantially reduced if the program was designed to attract the most productive land.

A program designed to serve the dual purposes of conserving resources and adjusting production would need to induce the conversion of around the 75 million-acre figure indicated. About one-half of the acreage covered by such a dual-purpose program would involve a conversion principally in the interests of conservation; with the other half shifted primarily in the interests of production adjustment.

For the purposes of farm production adjustment, it would be desirable to shift large acreages of cropland to pasture, forest, recreation and other uses as rapidly as feasible. In the interests of conservation, substantial acreages of the less productive cropland should be shifted more or less permanently to noncrop and nonagricultural uses. Substantial acreages of more productive lands may also need to be shifted within major agricultural uses for an interim period pending an expansion in agricultural cropland requirements.

On the other hand, there is the problem of keeping potential cropland from being brought into crop use before it is needed. Some conversion of pasture and forest land to cropland will take place as individuals seek to expand their operations and increase their incomes. While it would be difficult to control new land development and improvement, at least such activities should not be encouraged except for enlarging inadequate family farms or improving the productive efficiency of established farms. Existing programs should be reviewed and changed as necessary to keep land development and use more nearly in balance with requirements.

There is a potential of 638 million acres of cropland (classes I, II, and III) in the United States and another 169 million acres that might be used for limited or occasional cultivation at higher cost and with intensive conservation treatment. Thus, sufficient productive land is available to meet the foreseeable needs for food, for fiber, and for the nonagricultural requirements of an expanding population under the expectation of continued advances in technology and efficient uses of land and water resources.

As a Nation, we are fortunate in having such a large cropland potential. It is a valuable national asset which should be conserved to meet future needs as they arise. In the meantime, any excess above requirements for crop production can be used for meeting expanding needs for pasture, forests, recreation, wildlife, and urban and industrial uses.

Many of the projected land-use shifts are related directly to population growth. Shifting to urban and industrial uses will depend mainly on site and area locational advantages and local planning and zoning. Other shifts out of farm use to public facilities, recreation and wildlife



purposes will require technical and financial assistance along with planning and guidance. The shifts between crop, pasture, forest and nonfarm uses will involve adjustments within farms and between farms, and will be facilitated by public programs.

In 1963, about 24 million acres were in the Conservation Reserve program, and about 25 million were in the Feed Grain Program. In addition, about 8 million acres were voluntarily diverted from wheat production, of which about 5 million acres were in summer fallow. Considering fallow as a crop use, the acreage in noncrop uses under diversion programs thus totaled 52 million acres. Conservation reserve contracts expired on about 6.7 million acres at the end of 1963, and on 3.3 million acres at the end of 1964. The bulk of the remaining 14 million acres under contract will expire by the end of 1969. Also expiring will be contracts under the Great Plains Conservation program, which will be terminating at an average rate of about 60,000 acres a year until the end of the decade. Lands released under these programs will be eligible to participate in any forthcoming land diversion programs.

Any land diversion programs established during the next few years should attempt to keep lands under the Conservation Reserve and the Great Plains programs that are unsuited for cropping from reverting to crop production. Owners of such lands having a crop allotment base should be encouraged to accept lump-sum payments for long-term contracts precluding crop use for an extended period. The amount of the lump-sum payments or contract period rentals should be less than the agricultural value of the land. Eventually, temporary or interim cropland diversion programs should be integrated with a long-term land use adjustment program.

In the following sections, alternative basic general programs are proposed to convert cropland to noncrop uses, supplemented by a series of programs to assist in converting cropland to special types of noncrop uses. These would be voluntary programs. Farmers having eligible lands could participate in the general program and participants could then select the particular supplementary program best suited to their circumstances.

#### General Cropland Conversion Program (Alternative I)

The program outlined would be expected to operate initially in conjunction with several particular commodity programs, rather than in their place. Although intended primarily to cover feed grains, its scope could readily be extended to cover crops that compete for land with feed grains, such as oil crops and wheat. It would also appear feasible to develop variants that could be applied to such commodities as cotton, tobacco, peanuts, and perhaps other cash crops.

The proposed program would contemplate two types of land-use shifts: More or less permanent shifts of cropland to noncrop uses; and temporary or interim shifts to such uses. The permanent shift phase of the program would be designed to cover lands unsuited for continuous crop production because of soils or other conditions. Incentives for such shifts would be in the form of diversion payments and cost-sharing assistance. The primary purpose of this phase would be resource conservation through encouraging land uses in accord with suitability.

The interim diversion phase would be designed to shift lands suited to continuous crop production to noncrop uses for specified periods. It would involve diversion and price support payments, together with cost-sharing assistance where appropriate. Its primary purpose would be to provide income and price support payments during such time as an imbalance exists between production and demand.

Diversion or other payments for croplands expected to shift to urban or other nonagricultural uses would be subject to special provisions such as payments or assistance to maintain open space in urban fringe areas or for establishing attractive approaches to recreation-type areas.

The procedure might be to classify the croplands of all applicants into the two categories according to their suitability for continuous crop use, with any existing acreage allotments for the farm apportioned between the two categories. Applicants might be required to enter into contracts to divert all their unproductive cropland to noncrop uses as a condition for participation in the interim phase of the program.

Croplands classified as unsuitable for continuous crop production would be eligible only for long-term retirement contracts of at least 10 years' duration. Farmers would have to agree to retire all such lands from crop production and not bring any new land of this type into crop use for the duration of the contract.

Unless otherwise specified, annual diversion payments would be made over the life of the contract. The applicant, however, would have the option of receiving a lump-sum payment in return for noncropping easement running twice the length of the contract. In case of a return to crop use under this arrangement, a pro rata share of the lump-sum payment and the cost-sharing assistance computed over the easement period would be refundable. No limits would be placed on the acreage that could be entered under the retirement program, other than area limits designed to avoid adverse community impacts.

Cropland having an allotment base and classified as suitable for continuous crop use would be eligible for short- or intermediate-term contracts of 2 to 5 years providing for the diversion of land to an idle status or to permitted uses. The owner would have the option of selecting the term of contract and the choice of available alternative uses.



Some flexibility could be introduced through expressing acreages in terms of main crop equivalents and permitting the substitution of equivalent acreages. For example, if corn under support prices and normal yields had a production value per acre twice that of barley, an acre of barley would have a main crop equivalent of one-half. Two acres of barley could then be substituted for one acre of corn in meeting diversion contracts. While the composition of the acreage retired might vary from year to year, cost-sharing assistance would be limited to establishing initial cover on a specified acreage.

The land-retirement phase of the program would stimulate the shift of unproductive cropland to conservational uses, provide an incentive for owners to establish noncrop enterprises, and provide an opportunity for some to shift to nonfarm work. The retirement program should permit a sharper differentiation in payment rates between productive and unproductive lands. It should reduce the possibilities of the production adjustment program from becoming overloaded with lands of inferior quality. As implied above, the impact of the retirement phase of the program on crop output would probably be rather modest.

The interim crop diversion phase of the program should have a more significant effect on output. Assuming acreages of average productivity, the immediate effect should be to reduce production about in proportion to the acreage diverted.

#### General Cropland Conversion Program (Alternative II)

This alternative would be designed mainly to supplement annual commodity programs in achieving a balance between the production and utilization of farm products through adjusting various types of cropland to noncrop uses. In the application of this alternative, no particular distinction would be made other than in the contract payment rate between productivity classes.

The principal features of this alternative include:

1. Long-term cropland retirement contracts for a minimum period of 5 years, and a maximum of 10 years.
2. Payments for the entire contract period in a lump sum or any combination of installments, at the option of the applicant.
3. Grazing of contracted acreage should be permitted as soon as this can be done without adverse impacts on the livestock industry.
4. Such uses as open space, natural beauty, recreation, prevention of air and water pollution would be considered appropriate uses for contracted acreage and cooperation could be extended to State and local public agencies in programs for such purposes.

5. Limitations might be placed on the proportion of the total eligible acreage contracted in a county.
6. Cost sharing would be provided for establishing conservation practices based on average costs.
7. The minimum contract would require the acreage diversion of one base or allotment, with any additional crop acreage eligible for inclusion.
8. Annual per-acre payment rates would take account of the productivity of the particular acreage being contracted, the rates offered for comparable crops under going commodity programs, and other criteria. The rate for a particular crop would apply only if the entire base were diverted. Lower rates would be established for nonallotment crops and payment rates would be reduced when grazing is permitted.
9. The competitive bid procedure would be used where appropriate.
10. Lands contracted previously under other programs would be eligible to the extent that their cropping history was retained.
11. The goal of the program should be to contract the equivalent of around 40 million acres of cropland of average productivity during the next 5 years.

#### Supplementary Adjustment Programs

A number of supplementary programs would appear desirable in order to adapt the general program to particular situations or to encourage shifts to particular types of uses.

Conversion of cropland to trees.--Certain inducements in addition to those provided under either of the general cropland diversion programs might be needed to encourage shifts to trees. Such modifications might include longer rental contracts, such as for periods up to 15 years, a higher proportion of planting costs, more supervision of planting, regulations governing harvesting in accord with good forest practices, cost sharing for timber stand improvement and favorable credit arrangements such as deferred repayment loans and low interest rates.

Long-term cost-sharing contracts geared to regional programs and authorized local area projects.--A balanced program of resource management should be sufficiently flexible to permit adaptations to regional and local area resource programs. Regional and local resource programs may require an accelerated application of particular phases of national programs.



Regional and area resource-management plans often necessitate the widespread adoption of land treatment and conservation practices as integral features of programs. Long-term cost-sharing contracts based on conservation plans are essential in order that landowners and operators may apply conservation practices and schedule the installation of land treatment measures in accord with the needs of the regional and area programs.

Provision should be made for the Department to carry out a program of long-term cost sharing and technical assistance wherever appropriate for regional and local area programs. For local project areas, such authority should be available for watershed protection and flood prevention projects, the 11 authorized river basin projects, resource conservation and development projects, rural renewal areas, and other authorized local projects. Long-term contract and technical assistance authority similar to that in the Great Plains should be available for such regional programs as Appalachia, the Northern Great Lakes and the various river basin program areas.

Recreational opportunities in agricultural programs.--Special assistance should be provided rural landowners and operators desiring to use their land and water resources for income-producing recreation purposes. With proper development and management, outdoor recreation can be a profitable alternative to other uses of certain areas and at the same time help meet a growing public demand. In order to help more rural people realize this opportunity, USDA assistance should be extended as follows:

1. Farmers, ranchers and other rural landowners should be given technical and financial assistance to help them develop ponds, lakes and streams for water sports and fishing, picnicking and camping sites, hunting areas, shooting preserves, vacation farms, cabin and cottage sites, and other recreational enterprises and facilities. Such enterprises should be developed in conjunction with balanced land and water use plans.
2. Federal cost sharing, technical assistance, and credit should be provided local organizations for acquiring lands, easements and rights-of-way, and installing minimum basic recreational facilities in conjunction with selected reservoirs and along streams, lakes, marshes or other water areas for recreation, wildlife and open space uses. The reservoirs, land and recreational facilities would be maintained and operated for public use by the local sponsoring organizations. This program authorized by amendment to P.L. 566 through the enactment of the Food and Agriculture Act of 1962 should be expanded.

3. Farmers should be compensated through rentals or payments for easements to preserve bogs, wetlands or swamps for the protection of wildlife habitat. Also, technical assistance and cost sharing should be provided farmers wishing to use diverted cropland for establishing wildlife habitat areas, including the reservation of wildlife feeding grounds.

Developing an attractive rural environment.--Land-use adjustment and resource-development programs should place greater stress on improving scenic beauty and the attractiveness of the countryside. Many opportunities are available for improving the appearance of the landscape and providing a better rural environment. Possibilities include conversion of acreages of agricultural land to provide scenery and open space, development of water impoundments for recreation and beauty, development of scenic belts along rights-of-way, upgrading farmyards and feeding lots, maintaining open space in urban fringe areas, and numerous others.



The development of an attractive countryside should become an integral part of resource development and land-use adjustment programs, including authorization for technical assistance, the incorporation of beautification features as costs of installing programs, and provision of cost sharing and incentive payments for participation by landowners and operators.

Particular consideration should be given to the use of rural lands adjacent to urban areas as a part of local plans to provide more adequate open space areas. Technical assistance should be extended to local governments in planning and developing all land areas for recreational developments and open space uses in cooperation with the Housing and Home Finance Agency and the Bureau of Outdoor Recreation.

Coordination of land-use adjustment programs with local plans.--Maximum use should be made of such development and planning activities and programs as watershed projects, soil conservation districts, conservancy districts, drainage districts, irrigation districts, mutual irrigation companies, river basin planning, rural area development, and other regional, State, and local organizations with which the Department cooperates. The objective should be to achieve maximum local and regional benefits in addition to national objectives of balanced land use.

USDA agencies should provide technical assistance and consultation in the development of comprehensive area and Statewide plans for outdoor recreation, wildlife sanctuaries, wilderness areas and rural beautification activities. Such services should be available for both public and private types of developments.

The Department should seek cooperative arrangements with States and with other Federal agencies that will contribute to rural land-use adjustment, and orderly resource development and management. Cooperating farmers and organizations should be expected to conform with State laws and with zoning ordinances and other official regulations governing land and water resources.

## Land and Water Conservation and Development

### Soil and Water Conservation Needs

Estimates of the magnitude of the needed soil and water conservation work to protect and improve the non-Federal rural lands were obtained from the Conservation Needs Inventory made in 1958-60.

About 889 million acres of privately owned land needs conservation treatment while about 549 million acres are adequately treated, have no problem, or are not feasible to treat. These acreages by land use are as follows:

Land use	: : Needing : treatment	:Not needing : treatment
Cropland-----	: 272	165
Pasture and range-----	: 365	133
Forest and woodland-----	: 242	201
Other land-----	: 10	50
Total-----	: 889	549

Cropland.--Conservation problems on cropland have been delineated into four types, namely, erosion, excess water, unfavorable soil and adverse climate. About 30 million acres of cropland are not subject to such problems. Conservation practices to protect, maintain and improve the land would differ in kinds and amounts depending on the nature of the problem.

About 234 million acres of cropland has the conservation problem of water and wind erosion of which 72 million acres, or about 30 percent, are protected by conservation treatment and 162 million acres need conservation treatment. Included among the conservation practices would be a suitable crop rotation alone for some areas; others would need a rotation containing grasses and legumes, stripcropping and grassed waterways, and still others may include terraces and a specified crop sequence. On land of irregularly undulating topography, where it is impossible to construct terraces and diversions or to lay out practical contour tillage patterns, it is necessary to rely on cropping systems that include varying amounts of grasses and legumes in the sequence, crop residues on the soil surface during critical erosion periods, proper tillage methods, and grassed waterways to achieve adequate conservation treatment of the land.

Too much water, either on the surface or in the soil profile, is the dominant problem on about 94 million acres of cropland, of which about 34 million acres, or 37 percent, are protected by conservation treatment and 60 million acres need conservation treatment. Problems involved are poor soil drainage, wetness, high-water table and overflow. It is necessary that these soils be kept as permeable as possible so that water can move readily through the profile. They need good cropping systems that make maximum use of such practices as proper and timely tillage, growing of grasses and deep-rooted legumes, management of crop residues, and the use of soil amendments. Also, surface and subsurface drains are needed where excess water is the only problem. Dikes and interception ditches are needed for some areas to prevent inundation. Other areas require land smoothing to prevent small pockets of water which impair crop production.

Unfavorable soils are the dominant problem on about 55 million acres of cropland of which nearly 19 million acres, or 34 percent, are protected by conservation treatment, and more than 36 million acres need conservation treatment. The several soil characteristics that tend to restrict plant growth in the root zone and present hazards or limitation to land use include



low moisture-holding capacity, stoniness, shallowness to layers that limit root development, acidity, salinity, alkalinity and low fertility, all of which are difficult to correct. The kinds of treatment needed depend on the soil problems involved. For salinity and alkalinity it would be necessary to rely on recurring cultural and management measures together with the use of grasses and legumes, crops tolerant to salt concentrations and soil amendments. Minimum tillage, deep tillage and chiseling help to prevent or shatter a compacted soil, cemented soil layer and plow soles that restrict water movement.

Land with the adverse climate problem includes land with insufficient rainfall, or with a short growing season in Northern latitudes or high elevations. More than 24 million acres of cropland have this problem. Adverse climate as a hazard cannot be eliminated, except in areas where insufficient rainfall can be supplemented by irrigation. In areas having short growing seasons as the limitation, crops need to be grown that are adapted to the growing season as well as to follow a cropping system that will protect the land.

Pasture and range.--Conservation treatment is effective on 133 million acres of pasture and range, or 27 percent of the total acreage devoted to this use. Of the 365 million acres requiring treatment, about 72 million need to be seeded to establish desirable plant cover, of which about half, or 36 million acres, are tame pastures. Nearly 108 million acres of pasture and range needs improvement of the plant cover by partial seeding or natural thickening of the stand by deferred grazing, by mechanical measures, or by the addition of minerals (mainly on tame pasture). In addition to the pasture and rangeland needing establishment or improvement of plant cover, about 185 million acres need positive measures to protect already adequate stands of vegetation from one or more of the following hazards: overgrazing, fire, erosion, rodents or encroachment of woody and noxious plants. Overgrazing is the most widespread hazard--of the 185 million acres needing some kind of protection of plant cover only, 163 million acres, or 88 percent, needs protection.

Forest and woodland.--More than one-half of the non-Federal forest and woodland needs establishment or improvement of the timber stand to protect the land and to achieve the production potential. An even greater proportion, largely overlapping in acreage, needs improved protection from fire, insects and other hazards. About 70 million acres, or 16 percent, of the 442 million acres of forest and woodland need planting; also, more than 160 million acres, or 36 percent, need thinning, pruning and other forms of cultural treatment. About half of the forest land does not yet have adequate protection against fire and insects or diseases. More than 252 million acres need improved fire protection, and 207 million acres need better safeguards from insects and disease. One-fifth of the total, or 82 million acres, needs protection against animals which limit the production of the woodlands.

### Watershed Development

The Soil and Water Conservation Needs Inventory shows that small watersheds containing about 1 billion acres have land and water problems requiring project-type planning and action for their solution. At the present rate of about 100 projects approved each year for construction, about 15 percent of the needs inventoried can be met by 1980.

The projected rate of watershed installations shown below is based on a projection of current levels of around 100 projects per year.

Item	:Prior to: : 1960	:1960 to: : 1965	:1965 to: : 1970	:1970 to: : 1975	:1975 to : 1980
Number of watersheds-----:	212	500	500	500	500
Millions of acres-----:	13	30	30	30	30

The projected effect on land use and water use by 1980 is as follows: 6.5 million acres protected from overflow; 10 million acres treated for erosion control; 800,000 acres of cropland diverted to other uses; and 790,000 surface acres on reservoirs for permanent storage.

The multiple-purpose concept continues to increase in importance in the watershed program. About 46 percent of the 611 projects approved to date have some objective in addition to watershed protection and flood prevention. Sixty-five percent of the approvals in 1964 were in this category.

Multiple-purpose projects approved to date are: 181 projects with agricultural water management; 63 with recreation; 54 with municipal water supply; and 49 with fish and wildlife.

Recreation is the fastest growing of these purposes. Besides the 63 projects already approved, in which recreation will play a prominent role, an additional 44 projects have received preliminary approval.

### Resource Conservation and Development Projects

The Department recently initiated a program of assistance in approved areas to local sponsors of resource conservation and development projects, under an authorization in Section 102 of Public Law 87-703. RC&D projects are designed to carry out programs of land conservation and utilization where acceleration of the current conservation activities, plus the use of new authorities will provide additional economic opportunities to the people of the areas.



The purpose of the program is to concentrate local, State, and Federal resource-development activities where the full force of local leadership can be utilized effectively in establishing and achieving local goals that will contribute most toward economic improvement.

The program permits local leadership to utilize and effectively coordinate all available assistance in devising and carrying out a plan for the orderly development, improvement, and use of natural resources to meet local, State, and national needs.

The Department has assisted local sponsors of 10 RC&D projects to prepare acceptable work plans and has started to help carry out project measures that require technical and financial assistance of the Department.

Public interest in the program is high. In addition to the 10 projects covering a total of about 17 million acres now being assisted, 21 applications are pending encompassing more than 43 million acres. This program should be expanded to permit the provision of a steady rate of assistance to at least 20 new project areas annually during the next 5 years, and at a higher rate thereafter.

New authorities are needed for Departmental financial assistance to legal sponsors for approved public fish and wildlife and public recreational developments, and for long-term cost-sharing agreements with landowners for needed land-use adjustments and land treatment in these and other situations.

#### Rural Renewal Program

A program of technical assistance and loans to stimulate long-range economic development in rural communities where family incomes are abnormally low has been initiated in five pilot areas.

The rural renewal program is designed to assist local public bodies to plan, develop and carry out a complete economic development program. It is aimed at eliminating chronic rural underemployment, fostering sound rural area economies, strengthening family farming and increasing the incomes of farm and other rural people. Its main purpose is that of stabilizing, improving, conserving and developing the natural resources of project areas to assure the permanence of the economic gains achieved. This includes development of adequate family farms, improved housing, sanitation, multiple use of land and water resources and provisions of recreation and wildlife areas. Technical assistance is provided to assist local groups in planning and carrying out an overall rural renewal program in such areas and to make surveys, studies and feasibility determinations of specific projects. Long-term, low-interest loans are made to local public agencies for developing projects such as family farms, rural homesites and other related land conservation and utilization projects.

Rural renewal loans may be made to eligible local public agencies for such purposes as correcting maladjustments in land use, including purchase and consolidation or subdivision of tracts for resale for farm or nonfarm use; reforestation and related services; development of lakes, greenbelts, public playgrounds, parks, grassland areas, and wildlife areas; and development of water and sanitation facilities and community buildings directly associated with land-use and conservation projects.

Technical assistance is provided to enable local groups to develop plans and programs for making better use of the resources of the areas and in securing the services of all other agencies of the Federal Government in implementing community action programs.

Approximately 800 rural counties throughout the country are experiencing heavy out-migration, undue natural resource depletion and continued economic deterioration. Family farms along with commercial and industrial enterprises, public services and community facilities are no longer adequate to maintain a prosperous economy. In many of these areas the natural resources have been exploited and depleted to the extent that a complete program of rural renewal through concerted community effort is the most expedient means for reestablishing a prosperous and progressive economy.

A program of technical assistance and loans to local public agencies to assist them in revitalizing their areas by the development of the human and natural resources is an effective tool for solving many problems in these low-income areas through alleviating severe poverty and bringing parity of opportunity to disadvantaged groups. A recommended acceleration program is 20 additional areas in 1966, and an expanded rate of increase thereafter until the needs of all counties are served.

#### Family Farm Improvement

A major objective of the Department of Agriculture is to provide appropriate and needed services to preserve and improve the family farm pattern of American agriculture and to improve farm and rural living.

All services of the Department should be made available to assist in establishing fully adequate family-farm units from land and water resources that may become available from those leaving agriculture. Rural development, credit, and training should also be provided to facilitate the shift of some farm families, who are now on farm units which do not provide a living and full employment, into other gainful occupations. High priority will be given to development of new opportunities in rural areas. Such employment shifts will benefit the families and permit needed adjustment in land use. It also will make additional resources available to farmers who remain in agriculture.

A growing number of families remain on farms that no longer provide a satisfactory level of income and now obtain part- or full-time nonfarm employment within commuting distance. Assistance to these families needs to be directed toward helping them and the communities in which they live



to fully utilize and develop their resources for wholesome rural living and economic improvement. Families who are not able to leave their farms or to take nonfarm employment because of age, ill health, education, or personal preference, will be assisted to achieve the maximum rehabilitation possible.

While operator-ownership of farmland is to be encouraged, it is recognized that some family farmers will continue to be renters or part owners. Under some circumstances this may represent the most desirable tenure position for them. However, the program of loans for farm ownership by qualified farm families should be accelerated.

Loans and grants should be extended to improve housing for owners, tenants, hired labor, and migratory workers on farms.

Credit, research, and technical assistance should be focused on providing modern electric, domestic water, and communications services to meet the needs of agriculture and improve farm and rural living.

Based on past experience, it is estimated that about 94 percent of the funds required for these programs would be recovered with interest.

To improve the economic status of farm families with very low incomes, a continuing concerted and coordinated effort by the Department in cooperation with local and State agencies, is needed to motivate and assist these families through sharply focused educational and technical assistance, cost-sharing, and loans.

#### State and Private Forest Land Development

About 395 million acres, or three-fourths, of the Nation's commercial forest land is in State, industrial, farm, and other non-Federal ownership. More than 90 percent of this area is in private ownership and three out of every four of these acres are in small private holdings.

Cooperative Federal-State-private forestry programs represent impressive efforts towards helping improve the timber situation on these small holdings, and towards meeting the Nation's forest resource goals. It is clear, however, that much greater accomplishment is needed.

The Department is now preparing a new program for forest lands in State, local, and private ownerships. Its objectives are to meet the Nation's growing needs for forest land resources and to improve the quality of rural life through profitable multiple use of these lands for recreation, timber, water, forage, fish and wildlife on State and private forest lands. The program seeks to prevent and abate environmental contamination and to enhance landscape beauty. Rural areas development, farm forest cooperatives, and Federal-State cost sharing form the key framework for the program. The private sector of the economy is asked to play a major role in the implementation of the State and private forestry program.

In concept, the program calls for a gradual, moderate expansion of existing Federal, State, and private activities and for a modest start in several new fields. Nine agencies of the Department would contribute to the operation of this program.

This program for forest lands in State, local, and private ownerships, plus the previous "Development Program for the National Forests," and "National Forestry Research Program" constitute a closely-coordinated outline for meeting the broad spectrum of unprecedented demands on all forest land and water resources that face the Nation in the next decade.

#### National Forest Development

Expanded development work is needed on the National Forests and Grasslands so that these public lands will meet their full share of present and future needs and keep pace with population growth and national economic development. A "Development Program for the National Forests" was transmitted to the Congress by the President in September 1961. This program includes all phases of multiple use-sustained yield management--water, timber, outdoor recreation, forage for livestock, and fish and wildlife habitat. It includes both long-term proposals to the year 2000, and specific proposals for the next 10 years. The program will be carried out as rapidly as possible within the overall budgetary requirements and financial resources of the Federal Government. The following paragraphs briefly highlight this program.

National forest watersheds will be protected and rehabilitated by soil stabilization and management to maintain or improve water quality and quantity.

The long-range timber goal for the National Forest System is an annual harvest on a sustained-yield basis of 21.1 billion board-feet of sawtimber by the year 2000. The program proposes to increase the harvesting to reach an annual cut of 13 billion board feet by 1972.

The planned development and management of the 60 million acres of rangeland in the National Forest System will provide increased forage. Range improvements and intensive management will be combined with adjustments in numbers of livestock or seasons of use as necessary.

The growth and development of the Nation has had a great impact on the national forests through increased use of recreation resources. It is estimated that this use in national forests will rise from the 102 million recreation visits of 1961 to 195 million visits by 1972. Scheduled activities include improvement of existing campgrounds; planning and developing new campgrounds and picnic sites; and planning and developing swimming, boating, winter sports, and public service sites.



There are 88 wilderness-type areas in the National Forest System totaling 14.6 million acres. Of these, 54 are Wilderness areas, 34 are Primitive areas, and one is the Boundary Waters Canoe Area in northern Minnesota. These areas will continue to be managed to protect and preserve the primitive environment for people seeking wilderness recreation.

One-quarter of the recreation visits to the National Forests and Grasslands are for the primary purposes for hunting and fishing. Habitat must be made fully productive to support fish and game populations needed for public use and enjoyment.

Protection of national forests from fire, insects, disease, weather, and destructive animals is also a task of major proportions. Better facilities and techniques for fire control and for more resources to cope with critical fire periods are programmed. Insect and disease control will be increased to a level that will substantially reduce the occurrence of large infestations.

A well-maintained system of forest development roads and trails is scheduled to meet production and service needs.

Within many units in the National Forest System the pattern of land-ownership is quite irregular. The long-range need is to acquire, by exchange or purchase, about 720,000 acres in key tracts to facilitate public recreation use of national forest land. Additional purchases of about 7 million acres are needed, primarily in the East, to facilitate administration and development.

Construction and maintenance of administrative and fire control improvements are needed. For example, the increasing use of aircraft will require an additional 25 landing fields, reconstruction of 37 existing fields, and construction of 1,820 heliports and helispots.

Direct financial revenues from the National Forest System are expected to rise to about \$230 million annually by the time the 10-year development program is completed. However, the real benefits of this development program will accrue during the years ahead in satisfying the many and increasing demands upon this particular national resource.

## Land and Water Planning

### Conservation Planning of Farms, Ranches, and Nonagricultural Land Units

The justification for providing technical assistance at public expense to individual farmers, ranchers, and other landowners is to (1) assure the protection of productive agricultural land to meet future needs of the Nation for both domestic and foreign use, (2) help bring about the efficient and profitable use of soil, water, plant, wildlife and recreational resources, and (3) help adjust land use and management to meet farm and community needs.

The conservation plans that farmers and ranchers develop with technical assistance are designed to (1) provide a high level of net income to the individual operation, (2) maintain or improve the productive capacity of the land, and (3) enable each operator to adjust production effectively on his operating unit.

Soils differ greatly in their suitability for varied uses. Through soil surveys and other resource inventories, assistance is given in recognizing the potentials and limitations of soils for different land uses. The low-farm incomes that prevail in some parts of the country stem partially from attempts to use land for purposes beyond its potential.

Many operating units are too small to adequately sustain a farm family, and many units have a large percentage of land unsuited for intensive agricultural production. Some of these, however, are well suited for other uses. In many cases, a combination of two or more farm units may be necessary to bring together appropriate land and water resources for an adequate family farm. Such adjustments usually require credit and financial management as well as land-resource improvement.

To move ahead more rapidly on soil and water conservation on private land, it is highly desirable to raise the rate of planning to at least 200,000 operating units annually, and to increase the number of plan revisions to about 100,000 annually.

The present rate of applying conservation systems is too slow to encompass 80 percent of private lands by 1980. During the next 15 years, the level of technical assistance for planning and application of conservation systems should be increased by 75 percent over the 1964-65 rate.

By 1980, conservation plans would need to be in use on about 70 percent of the acreage in private operating units (farms, ranches, suburban tracts, private timber holdings, rural residential units, etc.). An additional 10 percent can meet conservation problems with more limited technical assistance. Technical assistance to individual and groups of landowners and operators must be directed toward helping them plan and install conservation systems to meet individual, community and national needs and objectives.

#### Area Planning for Resource Conservation and Development

Department assistance is needed to help the people of many areas develop and carry out sound programs for the orderly conservation, development and utilization of their resources at an accelerated rate. Local initiative and leadership of a continuing nature is a first essential to such area development. The involvement of all appropriate interest groups from the entire area, town and country alike, is necessary to assure proper consideration of the many problems, opportunities, alternatives and consequences associated with the area's resources. And many individuals, groups and organizations must help make and implement decisions.



Area, State, and Federal public agencies can be most effective when assisting the local leadership as a team in a well-coordinated and harmonious effort, each in an appropriate way, to help assure success of the undertaking.

Such area resource-development planning is needed to make it possible for everyone who has a valid interest or contribution to make to do so with assurance that his interest is properly considered and his efforts will contribute effectively to sound development. And such planning is needed to assure that all involved will reap a reasonable reward from his investment in resource development.

Area plans are needed that provide a good framework for the many resource developments essential to meeting objectives and needs of local people. Area plans need to provide for agricultural and nonagricultural resource developments, e.g., open space, suburban developments, transition from farm to nonfarm uses, public and private recreational developments, proper location of roads and highways, preservation and development of wildlife areas, and creation and enhancement of natural beauty.

#### Comprehensive River-Basin Planning

Comprehensive river-basin planning is concerned with the conservation and development of water and related land resources in both the upstream and downstream areas in a river basin. The Department of Agriculture's participation involves determining and meeting the water needs for agriculture (including forests and grasslands) in the basin, and for municipal and industrial purposes, power, flood protection, drainage, water-quality control, fish and wildlife enhancement, and recreation in the upstream watershed areas. The Department also develops information on needed land-use adjustments, soil- and water-conservation measures, and production requirements on all of the lands in the basin under the conditions that are expected to prevail in the future.

The Senate Select Committee on National Water Resources recommended, and the Administration has adopted as an objective, the early completion of surveys and investigations of the major river basins in the country.

Joint consideration has been given by the Departments of Agriculture, Army, Interior, and Health, Education and Welfare to the river-basin surveys and investigations needed to attain this goal. The concerned departments have proposed comprehensive framework studies of 18 major regions encompassing the Nation, exclusive of Alaska, which is to be considered as a special case. The framework studies will provide projections of economic development, translation of such projections into demands for water and related land resources, hydrologic projections of water availability as to both quantity and quality, and projections of related land-resource use and management, so as to outline the characteristics of projected water and related land-resource problems and the general approaches that appear appropriate for their solution.

Such framework studies will provide general guides to future water-resource development and, in addition, indicate which regions, or sub-basins within them, have water problems calling for prompt detailed planning efforts, as well as those where no such problems are current or looming. These framework studies will provide a substantial contribution of fact and analysis to subsequent detailed plan formulation. It now appears that the comprehensive framework studies will be completed during the next decade.

The development of detailed, integrated river-basin plans will require participation by Federal, State, and local agencies. The present rate of planning falls far short of desirable objectives for detailed comprehensive river-basin planning. It is estimated, on the basis of current schedules, and at the scale of intensity of planning used in such river-basin surveys, that during the next 20-year period comprehensive detailed plans should be completed on one-half of the approximately 100 river basins remaining to be planned in the contiguous 48 States. Limitations on recruiting and training technical specialists and ability of non-Federal units of Government to participate would need to be overcome if funds were provided for faster progress.

Surveys of all or portions of river basins in cooperation with State water-resource agencies are contributing to better planning and use of water and related land resources in upstream watersheds in several States that are developing State water plans. In addition to assuring adequate attention to agricultural and forestry aspects of programs, participation by the Department in both the framework and detailed comprehensive surveys provides for proper consideration being given to upstream watershed needs and development opportunities. Encouragement through cooperative contributions should be given State water-resource agencies to include upstream watershed aspects in planning the use of their water resources.

#### Watershed Planning

Within the framework of available or anticipated comprehensive river-basin plans and with approval by the States, detailed programs and plans should continue to be formulated for upstream watersheds in response to applications for assistance from local organizations. Plan formulation and evaluation requires skilled and experienced technical specialists, as well as knowledgeable and determined local leadership. The watershed program has been an ever accelerating, popular, and much needed program for rural resource development. The program continues to provide a stimulus and incentive for the accelerated application of land-treatment measures. It forms a nucleus for community development. It leads to increased employment. This means creating more jobs and economic opportunity in rural America, overcoming the basic causes of rural poverty, and assuring access of rural people to better water, good sanitation, recreation, and other facilities and services that will enhance rural living.



The watershed activity is an important tool for implementation of several objectives of resource policy and rural-area development. Close to one-half of the approved watershed projects are in, or adjacent to, areas designated as having chronic unemployment or underemployment. Most of the Federal funds expended on these projects are to the direct benefit of the local economy. For example, an estimated 9,000 man-years of employment has resulted during the last four years from construction in P.L. 566 and Flood Prevention projects. Well over 300 new industries or businesses employing about 7,500 people have resulted from watershed protection work, with an equal additional amount of employment resulting from expansion of existing industries or businesses.

In order to meet 15 percent of the needs indicated by the Conservation Needs Inventory, detailed plans would be required on around an additional 2,000 watersheds by 1980.

#### State Agency Resource Plans

More effective use should be made of the powers of both the Federal and State governments in managing land and water resources. There has been a trend to extend Federal programs directly to landowners through more or less nominal participation by local and State organizations.

The States possess enormous powers and concomitant responsibilities in the direction and control of land and water resources. A way needs to be found to utilize these powers and responsibilities in resource management programs together with the extensive specialized technical skill and the vast financial resources of the Federal Government. Federal programs can be administered so as to develop strong incentives for State and local participation. Frequently there is too little responsibility required from the cooperating State and local organizations. Their contributions often are little more than nominal and sometimes do not induce the help that should be expected from an interested partner or coworker. Federal administrators could well pay more attention to the development of greater zeal through strengthening Federal, State, and local relations. Frequently, the sharing of responsibilities in program administration will produce large dividends. The various arrangements which the Department of Agriculture uses for local and State cooperation could be profitably reviewed and revitalized or modified as needs indicate.

There is need for an effective grant-in-aid program to encourage States to prepare land and water plans that would supplement and advance USDA and other Federal programs. Included would be cooperative programs to develop improvements in water law and administration, stronger resource district organizations, rural planning and means of implementing the plans, land-use changes and the protection of developed areas, open space areas, transportation facilities, parks, wildlife, and natural beauty areas, and other uses.

Several States are effectively administering strong programs pertaining to planning and management of natural resources. All States should be encouraged to do so. It is highly desirable that all Federal, State, and local resource use endeavors should fit into supplementing patterns. Plans to enable Federal, State, and local resource programs to complement each other could be placed into operation at a small percentage of the cost of the operating programs.

### Resource Surveys and Research

A comprehensive program of resource surveys and research is needed to guide management decisions at the farm, county, area, State, regional, river basin and national levels. The entire research and survey program of the Department dealing with land, water, and forest resources and their management should be greatly strengthened.

#### Resource Situation Inventories

Periodic situation and problem inventories are needed covering such categories as land resources, including current and potential use by productivity classes; water resources; including supplies, sources and development potentials; resource tenure by major classes of resources; resource institutions, including legislation, resource districts and resource regulations; rural area inventories, including income and employment, age and training, housing, and available public facilities; and inventories of complementary resources such as fixed and operating capital.

#### Soil Survey

Soil surveys have many uses such as: broad land-use planning; land-use adjustments; detailed farm, ranch, and watershed planning; land appraisal; tax assessment; highway engineering; urban-fringe planning and development; and agricultural research planning. Soil surveys are based on intensive study of our land.

Soil surveys include soil maps and appropriate text. The published text includes descriptions of the soils and their productive capacity and potential uses. The hazards and limitations of each soil are given for each adapted land use. Rapidly changing interpretations, such as fertilizer recommendations and crop varieties, are given in frequently revised handbooks and State leaflets. Soil surveys show the location of soils suitable for cultivation and those not suitable.

Information is gathered about individual soils from research, experience of farmers and ranchers, field trials, laboratory studies, and other sources. Estimates of proposed program accomplishments based on the rate that trained soil scientists are expected to be available follow:



Item	: 20-year : : projec- : : tion :	First : 5 years :	Second : 5 years :	Third : 5 years :	Fourth : 5 years :
Millions of acres mapped---	991	234	471	286	--
Man-years required-----	31,260	7,335	10,125	7,575	6,225
Number of publications----	2,718	250	650	800	1,018

The above schedule provides for completing the soil mapping of all lands needing detailed surveys by 1980 and for completing the publication of all surveys in an additional five years. The program includes the revision of earlier surveys of approximately 80 million acres. It is recognized that this rate is slower than is desirable from the standpoint of the critical need for soils information.

A maintenance staff of soil scientists of sufficient size should be provided after 1980 to complete soil survey publications, to keep soil interpretations and soil mapping up to date and in line with new developments in agricultural technologies, and to provide onsite technical assistance to conservation planning technicians and others.

It is estimated that about 10 percent of the cost of soil surveys will be borne by State and Federal agencies outside the Department of Agriculture, such as Bureau of Indian Affairs, Bureau of Land Management, and Land-Grant Colleges.

#### Research Program

Resource-related research areas in which there is particular need for expanded study are:

1. Grass, browse, and harvested forage.--The 1980 projection indicates a substantial need for more pasture, range, and harvested forage. Research should be increased on breeding grasses and legumes for large, vigorous seedlings; on high-yielding, vigorous, adapted, palatable, nutritious forage plants; and on disease and insect resistance. Also needed are studies on machinery for seeding, harvesting, pelleting, and handling forages to reduce labor costs and to preserve nutritive values of forages. Pasture and range research to develop suitable management systems for the many different types of vegetation, livestock, and game should be accelerated. Particular need exists for the development of plant species that are heat and drought tolerant.

2. Soil management.--There should be expansion in basic research necessary to control wind and water erosion, and salinity; on soil properties, processes and management; on soil-water-plant relationships; on the interaction of fertilizer, water use, crop variety, pesticide use, and

tillage and other management practices; and on efficient, economic, and sustained conservation farming. We also need more research on nutrition of animals and man as affected by properties of soils, plants, and climate.

3. Hydrology and water management.--An expanded program in basic and applied research in hydrology and water management is essential to achieve maximum beneficial use of our limited water resources. Research is needed on sedimentation, watershed hydrology, hydraulics of irrigation, drainage, and watershed protection; on water supply structures, channels, and facilities; on conservation of water supplies for agricultural use; on irrigation design principles, requirements and facilities; on moisture conservation on crop and rangeland; on the management of forest and range vegetation to influence quantity, quality, and timing of water yield; and on factors affecting evapotranspiration of water from plant and soil surfaces.

4. Protection against diseases, insects, weeds, and other pests.--We need expanded research on the development of more effective control methods against crop, livestock, household, and other pests--insects, diseases, weeds, fire, air and water pollution, and chemical residues. Basic research on biological and cultural control of insects and diseases, and on the nature of insect resistance to insecticides, especially on genetic resistance, is urgently needed. Methods for control of phreatophytes and of rodents; research on the population ecology of game species and of songbirds; and research concerning the habitats for game and fish are needed.

5. Agricultural adjustment.--More economic research on programs of production management, and price and income support, and their effects on conservation and use of land and water resources, is needed. Basic research to develop models and methods and to evaluate probable costs and returns should be greatly expanded.

Expanded research on problems of agricultural adjustment should emphasize studies of land tenure; credit; analysis of the effects of new technologies; interfirm integration and specification buying; migrant labor; training and educational needs; economics of farm size; assembly, processing, and distribution of farm products; consumer acceptance and food habits; and alternate use of purchased and nonpurchased inputs.

More economic research on new crops, on new industrial products from agricultural raw materials, and the utilization research to make them feasible is needed.

6. Low income farms.--Research addressed to the special problems of low income farms should be expanded with emphasis on combinations of labor-intensive crops, especially grass farming with sheep and cattle, small fruits, vegetable ornamentals, poultry, feeder pigs, and replacement heifers; on machinery adapted to small fields, economical and flexible in use; on soil and water research adapted to soil-building in hill lands; on improved farm forestry; on wildlife habitat; on fish farming; and on housing and family living, including training in use of credit and income supplementation from recreation, game, and fish. Research is needed to



assist in bringing low income farms to economic adequacy. Research is needed on utilization of low quality timber and little-used species, typical of farm forest properties, to aid in development of new and diversified industries and outlets for timber products.

7. Resource economics.--Economic studies to provide the bases for sound land and water resources policies and optimum land-use adjustments should be further intensified. Types of analyses needed include: future requirements for resources, production potentials, and competition between uses; procedures for the formulation, evaluation, and selection of development programs; equitable arrangements for sharing program benefits and costs; legal bases and organizational arrangements for implementing resource programs; the application of management and conservation to maximize farm returns; and the influence of resources and resource management on area, regional and national economic growth.

8. Farm electrification and power research.--More research needs to be conducted in the application of electric lighting and other radiation to animals, plants, seeds, and insects, and in new and more effective applications of electric energy to cut farm production costs, produce better farm products, and conserve human energy. Additional studies are also needed of the merits and limitations of other alternative sources of farm power.

9. Forestry research programs.--The forestry research program should be expanded to put forestry on a sound technological basis. Objectives of a comprehensive National Forestry Research Program were outlined in a report sent to the Congress by the Secretary of Agriculture in April, 1964. The proposed research program provides for extension and strengthening of the support given to cooperative programs with colleges and universities to stimulate forestry research by these institutions. The objectives include:

Improve the growth and quality of timber crops through tree breeding, reforestation, and cultural operations, in harmony with other forest land uses.

Develop land use practices to preserve favorable hydrologic conditions. Develop methods to promote snow accumulation, regulate streamflows, and increase infiltration into the soils.

Improve basis for estimating range productivity and safe stocking rates and for judging range condition and trend. Devise systems of management to increase or maintain desirable vegetation, to protect soil, water and forage values.

Develop management and improvement practices for wildlife habitat in various plant communities. Determine ways to harmonize wildlife production with timber growing, domestic livestock, and other uses of forests and rangeland.

Improve methods of selecting, developing and managing forest areas for recreation use. Determine characteristics of recreation demand, and opportunities for privately owned recreation enterprises.

Develop new and improved technology of forest-fire prevention and control, and develop new management practices that will reduce forest fire hazards and losses.

Improve methods of detecting insects and preventing and controlling insect damage, including biological and natural controls.

Develop methods to reduce impact of disease upon the forests and upon wood products, and develop special measures to alleviate forest disease epidemics.

Improve wood products through more effective preservation and better seasoning, glues, and manufacturing practices and find profitable uses for unused woods and residues.

Improve all aspects of mechanization in forestry practices including logging, site preparation, transportation, and primary processing.

Provide continuing and up-to-date inventories of timber supplies, growth, mortality, and cut for industrial use, and prospective supplies and demands for timber and wood products.

Analyze economic aspects of timber growing, protection and other forestry practices on small ownerships and on large public and private holdings.

Improve and expand markets for forest products through more efficient harvesting, processing, and distribution, and consumer use of timber based materials.

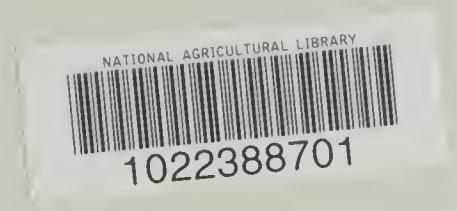
10. Environmental contamination.--Adequate information is lacking on the extent, intensity, location and significance of various types of environmental pollution. Principal types of pollution of significance in rural areas that are in need of study include product contamination as it affects human and animal health; water pollution; soil pollution; air pollution; and landscape blight. While research on the physical, chemical and biological aspects of pollution has been limited, it has been practically nonexistent on economic and related aspects.

Such studies are necessary to develop workable means for abating, preventing or managing the problem in order to minimize adverse impacts. The primary aims of such research include determining the measures and costs of reducing pollution to acceptable levels, assigning responsibility for administering abatement measures and determining how the costs should be distributed among the interests concerned.



There is pressing need for the Department to undertake a comprehensive program of research covering all significant aspects of environmental pollution originating in or impinging on rural areas.

11. Research facilities.--Construction of additional research laboratories and related facilities at strategic locations throughout the country is an essential part of the Department's research program.



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